THE

POPULAR SCIENCE MONTHLY.

JULY, 1892.

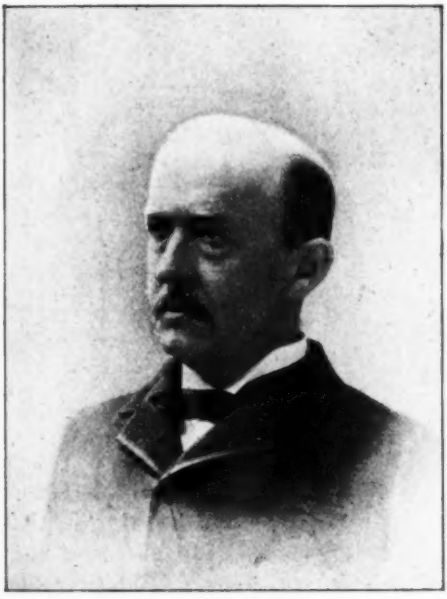
ANTHROPOLOGICAL WORK IN AMERICA.

By Prof. FREDERICK STARR.

THE object of this article is not to present a history of anthropology in America, but to sketch briefly some of the work at present done, so as to show the aims and methods of our workers in the science.

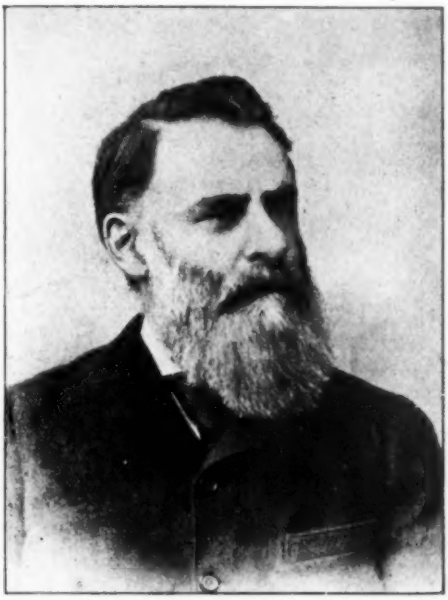
That anthropology is yearly attracting greater attention among us is shown by the way in which institutions of learning are recognizing its importance. Not many years ago a scientific journal made the statement that but one institution of learning in the United States, the University of Rochester, had the science upon its curriculum. The way in which it was introduced there is somewhat interesting. At that time the scientific work offered to students at Rochester was admittedly insufficient in quantity, but the way seemed hardly clear to the employment of any additional teaching force to do extra work. At this stage of affairs Prof. Joseph Gilmore, in charge of the Department of Rhetoric and English Literature, offered, in some degree at least, to meet the need, to announce an optional course in anthropology. The work was very elementary, extending over but a single term, and covering the field considered in De Quatrefages's little volume, The Natural History of Man. From the beginning the course was a favorite one, and many students elected it. The effect was good and the example has been followed. Since that time instruction in anthropology has entered into the work of a considerable number of American colleges and universities. It is suggestive to inquire how and why it has been introduced. At Yale, Prof. Sumner has for several years given such courses, because he felt that students unacquainted with the science could not profitably undertake

his work in political science and economics. At Union College, Prof. Hoffman has found it necessary to give lectures on anthropology, as preliminary to the best work in psychology. At the University of Mississippi we believe it has been introduced as fundamental to historical study. In one way or another the subject has been crowding itself into the curricula, until now, in addition to the institutions already mentioned, Brown, Harvard, Clark, Vermont, and the University of Pennsylvania offer facilities for such study. At the new University of Chicago anthropology is to be recognized, and several courses, covering a wide field, will probably be offered. The work at two or three of the universities deserves special notice. At Yale, Prof. W. G. Sumner gives two courses of instruction in alternate years—one for undergraduates, the other for graduate students. The elementary course is based upon Tylor's Anthropology and Joly's Man before Metals, both of which are carefully read by the students, and form the basis of class-work. Lectures, discussions, and preparation of original papers upon selected topics make a suggestive and excellent course. Supplementary reading of important French and German writers is arranged for such students as desire to do the best work. In the second course similar methods are pursued, and the required reading consists of Topinard's Anthropology and Letourneau's Sociology. These two courses are deservedly popular with the students. The instruction work in anthropology at Harvard is an outgrowth of the Peabody Museum of American Ethnology. Of the museum itself we shall speak later. The work of Harvard University is divided into twelve departments, of which the most recently established is the Department of American Archæology and Ethnology. This department is equal in rank to any in the university, being on the same footing as the Department of Ancient Languages, or the Department of Mathematics. Graduate work leading to a Ph. D. degree is offered. We quote the following announcement from the latest catalogue:



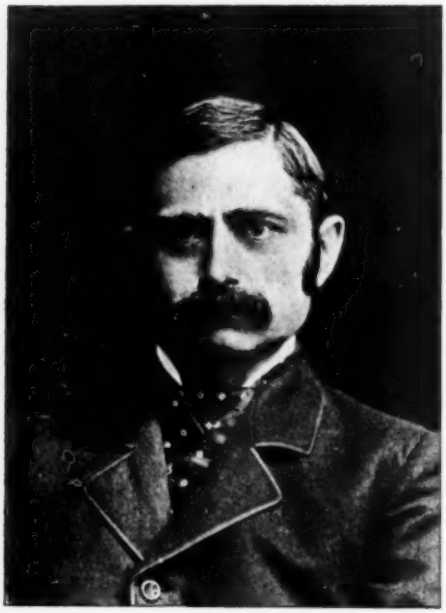
PROF. W. G. SUMNER.

"A course of special training in archæology and ethnology, requiring three years for its completion, will be given by Prof. Putnam. It will be carried on by work in the laboratory and museum, lectures, field-work, and exploration, and in the third year by some special research. The ability to use French and Spanish will be necessary. For this course a knowledge of elementary chemistry, geology, botany, zoölogy, drawing, and surveying is required, and courses in ancient history, ancient arts, and classical archæology are recommended as useful." Students are now pursuing such study at Harvard under Prof. Putnam's direction. Since the establishment of this department a fellowship at Harvard University has been founded by Mrs. Mary C. Thaw, of Pittsburgh. Founded largely from personal admiration of Miss Alice C. Fletcher, and appreciation of her work, the fellowship is to be held by this lady during her life. In the event of Miss Fletcher's death, "the income from the fund of thirty thousand dollars is to be paid as a salary to such person as shall be appointed by the trustees of the museum to carry on the same line of work and research relating to the Indian race of America, or other ethnological and archæological investigations." At the University of Pennsylvania a special chair of American Archæology and Linguistics is held by Dr. D. G. Brinton, than whom no man in America is better qualified to offer courses in Indian languages. The broadest anthropological work at present offered in an American institution is that conducted by Dr. Franz Boas at Clark University, Worcester, Mass. Dr. Boas received his training in anthropological study in Germany. Although partial to work in the direction of comparative mythology and linguistics, he is thoroughly trained in the methods of ethnography and physical anthropology. A great traveler and an excellent field-student, he has done admirable work among the Eskimos and the tribes of the northwest coast of America. For several years he has directed an exploration among these people, supported by a fund



PROF. F. W. PUTNAM.

supplied by the British Association for the Advancement of Science, and his annual reports, published by that body, have been veritable storehouses of new and valuable information. Dr. Boas has lately prepared an important work upon the Mythology of North America, which will soon appear from the press. Dr. Boas is in charge of the Physical Anthropology Section of the Department of Ethnology and Archæology of the World's Columbian Exposition of Chicago. In connection with this work he plans to gather such a mass of anthropometric data concerning the red man as has never before been brought together. Within the next few months he hopes to have fully twenty thousand Indians of different tribes carefully measured. Important facts may be discovered from a careful study of the material thus secured. Dr. Boas at present lectures to a class of students upon statistics in anthropology and other sciences; how to secure, tabulate, and use them. Special graduate students are put at work in his laboratory, which is fairly equipped, upon some line of original research and study, the results of which may be published as contributions to science.



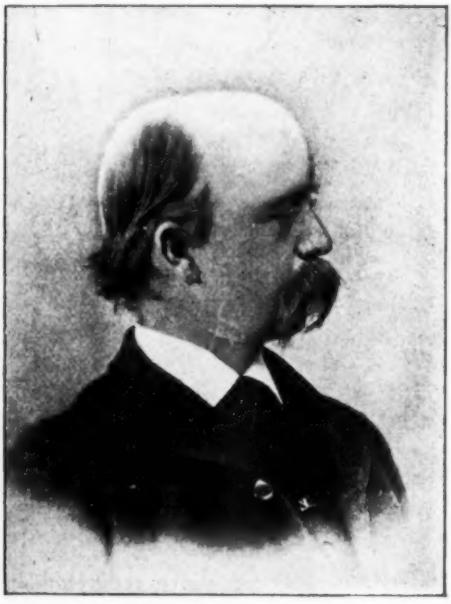
ALBERT S. GATSCHET.

Museums in ethnography and anthropology are not yet numerous in America. Collections of considerable size and worthy of special notice exist at Cambridge, Salem, New York, Philadelphia, Washington, and Davenport. Of very great importance is the Peabody Museum of American Ethnology at Cambridge, connected with Harvard University, and under direction of Prof. Frederick W. Putnam. At first a zoölogist, especially interested in fishes, Prof. Putnam has long since laid aside everything except archæology. The present work and importance of the museum are mainly due to him. Nine large rooms are filled with valuable collections, a great part of which have been gathered under his personal supervision. No man has done so much to bring about the careful and systematic method of excavation of mounds now followed as he. To refer to all the objects of

special interest in this museum would take us far beyond our limits. Among the collections are magnificent series from the mounds of Ohio and the stone graves of Tennessee; complete altars of baked clay from Ohio "altar mounds"; Kentucky cavern finds; interesting series from the caverns of southern California, comprising perishable objects seldom preserved, such as a feather head-dress, basketry, wooden objects, and a wonderful lot of bone whistles found in a single basket; Flint's interesting gatherings from Nicaragua; collections from the old cities of Yucatan; the Agassiz collection from ancient Peruvian graves; the rich yield from the Madisonville cemetery: Wyman's collection from the fresh-water shell-heaps of the St. John's River, Fla.; and the famous Abbott collection from New Jersey, the basis of Dr. Abbott's paper, The Stone Age in New Jersey. Two other series deserve especial mention—the one of specimens from Honduras, some of the pottery in which is exceedingly interesting as showing a field for exploration scarcely known to our archæologists. Prof. Putnam has made arrangements with the Government of Honduras whereby the museum has the exclusive right of archæological exploration in that country for a term of ten years. Mr. Saville, the museum assistant, is now in that field. Very important is the great collection of American "palæoliths." Here are Dr. Abbott's argillite implements from the Trenton gravels, and the skulls from the same locality; Miss Babbitt's quartzite flakes and rude implements from the Minnesota drift deposits; and the Ohio, Indiana, and Delaware specimens from post-glacial or glacial deposits. Nowhere else is there any such an exhibit of these rude, early types, which have caused so much bitter discussion. We have spoken only of American collections, but there are also in this museum series illustrative of European archæology, fine specimens from the South Seas, and a Semitic museum, which deserve more than a passing reference. The museum has published annual reports for twenty-four years; some of them have

Dr. D. G. Brinton.

contained papers of much value. At present octavo monographs by such writers as Mrs. Zelia Nuttall and Mr. A. S. Gatschet are also published by the museum. One important and original accomplishment of the museum remains to be mentioned. In Adams County, Ohio, on a high bluff at some distance from the nearest railroad town, is the *Great Serpent Mound*, in some respects the most remarkable monument of antiquity in America. It was in danger of destruction, when Prof. Putnam made an appeal for funds for its purchase and preservation. Ladies of Boston responded to the appeal, the money needed was raised, and paid over to the museum, which made the purchase. The place has been pleasantly laid out as *Serpent Mound Park*, and the old monument itself has been carefully surveyed, restored, and put into a condition to withstand the destroying action of time and the elements. Prof. Putnam is Director of the Department of Ethnology of the Columbian Exposition, and in connection with its work has kept parties in the field excavating mounds and gathering material. His plan of display is a vast one, and a most instructive and interesting object lesson in American anthropology (ethnography, physical anthropology, archæology) is sure to be prepared.



Dr. C. C. Abbott.

New York is not so much a center of anthropological work as it should be. At the American Museum of Natural History there is much good material. Here one may see what is left in America of the Squier and Davis collection from the Ohio mounds, containing many specimens figured in the Ancient Monuments of the Mississippi Valley; the Squier collection from Peru, comprising a wonderfully fine lot of greenstone carvings; the collection of Colonel C. C. Jones, made chiefly in Georgia, numbering five thousand specimens, and the basis of his book, The Antiquities of the Southern Indians; a remarkable collection in European archæology, including series from the river gravels and caves of France, from the lake dwellings of Switzerland, and from the famous localities of Denmark; the Emmons collection from

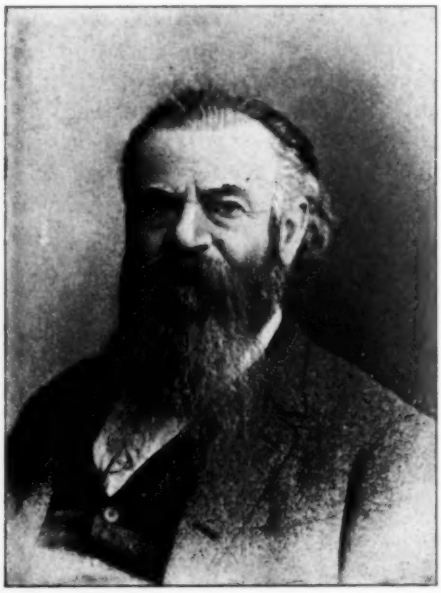
Alaska, which is perhaps the best collection from the Tlingits; the Sturgis collection from the South Seas, recently purchased by the museum, and far larger than any other in America, and surpassed by few in Europe. Besides these collections belonging to the museum, and on display, there are in the building two remarkable and extensive series belonging to private collectors—men of wealth—Mr. James Terry and Mr. Andrew E. Douglass. The Terry collection is mainly the personal gathering of the owner, and is particularly rich in Pacific coast specimens. The Douglass collection is made up of exceedingly choice stone implements from every part of the United States, and it is unsurpassed in the number of rare and beautiful objects—banner-stones, bird and bar amulets, hematites, and grooved axes. These two collections will no doubt ultimately become the property of the museum. Notwithstanding its treasures in material collections, the museum has never published one line of contribution to anthropological science, nor has it undertaken, apart from a few lectures to its membership, any educational work in the subject.

PROF. EDWARD S. MORSE.

In Philadelphia a vast amount of work has been done by a few individual workers, with no pecuniary return, and with but very little financial backing. What is there has been brought about by truly heroic work from love of the cause. The work is mainly done at the Philadelphia Academy of Science or at the University of Pennsylvania. At the academy is the Morton collection of crania, gathered by our earliest great anthropologist, and at that time one of the largest in the world; here, too, are the collections in archæology gathered by Poinsett, Vaux, and Haldeman. For several seasons, including the present one, Dr. D. G. Brinton has presented at the academy courses of lectures upon some ethnological subject. The most active work in Philadelphia at present, however, is at the university. In reference to it, Mr. Culin, who is one of its heartiest supporters, writes us:

"The chief center is the new Department of Archæology and

Palæontology of the University of Pennsylvania, which is maintained by an independent organization—the University Archæological Association. This department covers a broad field. It has had an expedition for two years in Babylonia; it contributes annually to the Egyptian Exploration Fund; and has carried on explorations in various parts of the United States. In two years it has established a museum in four sections—American, Babylonian, Egyptian, and Oriental—with remarkably full collections in each. It has just opened a loan exhibition of objects used in worship, intended as the first of a series of such special exhibitions of an educational character in which the resources of the museum and of private collections will be made accessible and displayed."

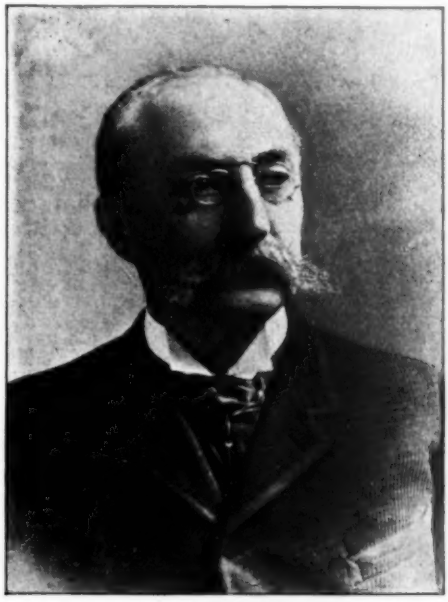


MAJOR J. W. POWELL.

An unusual number of active societies exist in Philadelphia, which more or less directly assist anthropological science. Such are the American Philosophical Society, Numismatic and Antiquarian Society, and the Oriental Club. In all of these, so far as anthropological work is concerned, Dr. Daniel G. Brinton is a moving spirit. Dr. Brinton scarcely needs an introduction to American readers; no one has done more to make anthropology known to the people and to raise up other workers. His writings upon American religions are delightful reading. For several years he has edited a most important work, the Library of American Aboriginal Literature; of this some eight volumes have appeared. Each volume is devoted to some one literary production of the American race. The original text is printed in full; and a translation, critical notes, and a vocabulary make the subject available to the student. Dr. Brinton has lately issued two little volumes—Races and Peoples and The American Race—of popular but scholarly character. The other workers in Philadelphia who are best known are the curators of the departments of the University Museum, Dr. C. C. Abbott, Prof. Morris Jastrow, Jr., Mrs. Cornelius Stevenson, and Mr. Stewart Culin. Dr. Jastrow is one of the best Semitic scholars in America. Mrs. Stevenson is perhaps

our only lady Egyptologist. She may justly be compared in that field to Miss Edwards, of England. Her lectures on Egyptian subjects have made a sensation.

To the work of Dr. C. C. Abbott we briefly referred in connection with the Peabody Museum at Cambridge. Dr. Abbott lived for many years at Trenton, gathering a great collection of archæological specimens from the State of New Jersey. The series, now at Cambridge, numbered many thousands of specimens, and was the basis for The Stone Age in New Jersey and for the later book Primitive Industry. In 1875 Dr. Abbott found the first argillite palæolithic implements in the Trenton gravel. This gravel is said by geologists to date back to the close of the Glacial Period, and any evidence of human workmanship in undisturbed gravels of that kind carries the existence of man in the Eastern United States back to a considerable antiquity. A lively warfare has been waged against these "finds." It has been questioned whether the objects *were* of human workmanship, and whether they were really of the same age as the gravels. But similar implements have been found in similar deposits in other States within the glaciated area, and each new discovery tends to establish those which preceded it. Since his connection with the University Museum, Dr. Abbott has continued field-work in the Delaware Valley, and has lately made many interesting discoveries, such as workshops where argillite implements (non-palæolithic, but ancient) were made and quarries where the Indians gathered their materials for arrow-heads and spear-heads. Dr. Abbott aims to exhaust the archæology of the Delaware Valley before he ends his work. Such thorough study of limited areas is what we most need in American archæology. After such work has been done for each section of the United States, then, and then only, can our students reach sure conclusions.



GARRICK MALLERY.

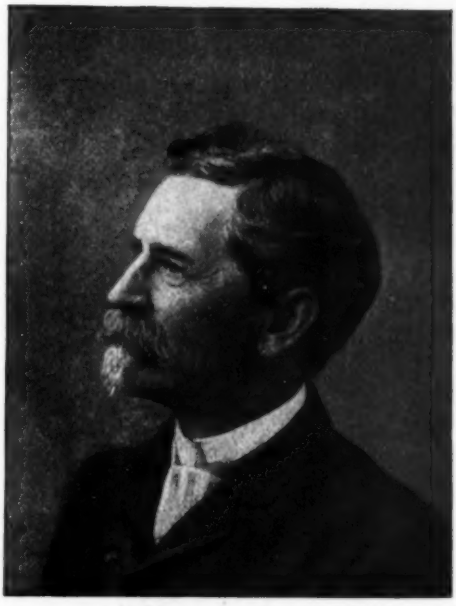
The loan exhibition of religious objects above mentioned is mainly due to the energy and efforts of Mr. Stewart Culin, who

finds his most interesting work in the neglected fields of popular superstitions and games, and who is an earnest student of comparative religion. The exhibition was formally opened on March 16th, when crowds of visitors were present. The collection is the first of its kind publicly shown in America. It is on the general plan of the Musée Guimet in Paris, and, although not to be compared with that in size, it presents some valuable features that are lacking there. Some eight hundred objects illustrated Brahmanism, Buddhism, Taoism, Mohammedanism, the fetich-worship of South Africa, the Shamanism of North America, the idolatry of Polynesia, and the old religions of Egypt. There has been much hard work given to this display, and great credit is due those who have been interested in its preparation.

While we speak of work done by noble individual effort and sacrifice, and without the assistance of Government or of wealthy organizations, we must describe what is done at Salem and at Davenport. No museum in America has exerted a greater influence than that in Salem, Massachusetts. A large proportion of the most active scientific men in our country, directly or indirectly, owe much of their first impulse and enthusiasm to some department of its work. In 1799 the Salem East India Marine Society was organized, with a membership confined to persons who had actually navigated the seas beyond the Cape of Good Hope or Cape Horn as masters or supercargoes of vessels belonging to Salem. Those were the palmy days of commercial supremacy and the seas were dotted with vessels from the old town. The third of the objects stated as reasons for organizing the society was "to form a museum of natural and artificial curiosities, particularly such as are to be found beyond the Cape of Good Hope or Cape Horn." The museum began November, 1799, with a gift of objects from Sumatra by Captain Jonathan Carnes. In course of time much choice material in ethnography was brought here—particularly from the South Sea Islands, China, India, Africa, and South

FRANK HAMILTON CUSHING.

America. Meantime, the Essex Institute was gathering collections in other lines and from the neighboring district. In 1867 the collections of the two organizations were combined in the old East India Marine Society Hall, becoming the property of the new organization—the Peabody Academy of Science. The academy has gone on quietly but constantly, with little blowing of trumpets, and good work has been done. Lately an additional exhibition hall has been built, and in it are displayed the ethnographical collections. No one in America who is engaged in studying the ethnography of the South Sea Islands can afford to neglect this series. Prof. Edward S. Morse, whose chief contributions to ethnography are his paper on Methods of Arrow Release and his book on Japanese Homes, is the director of the academy, and Mr. John Robinson is in charge of the museum. Some day the story of the Davenport (Iowa) Academy of Science will be an interesting chapter in the history of science in the United States. It has never had a large donation in money, and much of its work has been done by poor men. It has had a constant struggle to survive. It is certainly fit to live, for there, with no trained anthropologist or professional ethnographer to direct or develop a definite plan of work, has grown up an excellent collection in archæology. Probably nowhere except in Salisbury, England, is there so large a series of "curved-base pipes" of stone from the mounds; nowhere else is there so interesting a series of copper axes wrapped in cloth; nowhere, except at Washington, so fine a series of pottery from the Arkansas mounds, nor many much better collections of mound crania. Nor has the academy been silent. Notwithstanding its money poverty it has published valuable Transactions, by the exchange of which it has gathered a creditable library.



Prof. O. T. Mason.

Washington has become a great scientific center, and of the whole circle of sciences none is more cultivated there than anthropology. Under Major Powell—a remarkable organizer and an indefatigable worker—has been organized the Bureau of Eth-

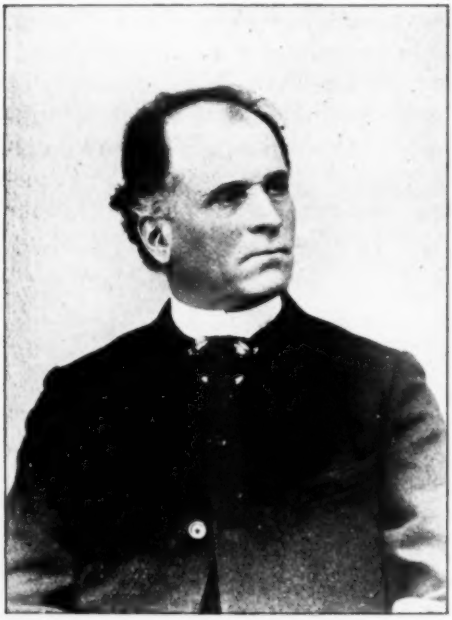
nology, with its band of workers each in some special line. Work is actively conducted both in the field and office, and the results are published as papers in the annual reports, as bulletins, or as monographs. Major Powell himself is our best authority on the Utes. For years he has been mainly interested in linguistics, and his Introduction to the Study of Indian Languages has led to the gathering of many vocabularies. The mass of linguistic material in the possession of the bureau is almost incredible. In his last annual report Major Powell presents a paper upon the Linguistic Families North of Mexico. This paper is accompanied by a map showing the conclusions he reaches. The best-known linguist in the employ of the Bureau of Ethnology is Mr. Albert S. Gatschet, whose studies are most thorough and critical. Mr. Gatschet is by birth a Swiss, and has devoted his time since 1875 to the study of anthropology and the American races and languages. Of his more important works, the earliest is the Migration Legend of the Creeks, in two octavo volumes; the original Creek text, translation, vocabulary, and critical notes upon the language and ethnology of this important tribe compose the work. Very recently the Government has published his great work upon The Klamath Indians of Southwestern Oregon, in two quarto parts. Mr. H. W. Henshaw, the general assistant in the bureau, has also collected much linguistic material, especially in California. One of the most complete studies, the results of which the bureau is printing, is that of Rev. J. Owen Dorsey among the Omahas. Mr. Dorsey has already published extensively upon the language and the sociology of this people, but he has still much material. Mr. James Mooney has made a special study during three field seasons of the Cherokees of the North Carolina Mountains, and his report upon their ceremonials has just appeared. One of the brightest workers of the bureau is Mrs. Stevenson, whose husband was one of the most indefatigable collectors in the Pueblo regions. Mrs. Stevenson's Religious Life

Hon. Thomas Wilson.

of the Zuñi Child is a very good bit of work. Two of the bureau force have been particularly interested in pictography—Colonel Garrick Mallery and Dr. W. J. Hoffman. The former was fortunately sent to the seat of the Dakota war in 1876. He there found a rude and interesting native picture record, which he published in 1877 under the title A Calendar of the Dakota Nation. At its founding, during that same year, he was invited to a position in the Bureau of Ethnology. He has continued his study of picture-writing and has investigated gesture language, and by publication and encouraging research has added much to the knowledge of both subjects. Through his Israelite and Indian (Vice-Presidential Address before the American Association) and other articles published in these pages, Colonel Mallery is already known to the readers of this journal. With Colonel Mallery, Dr. Hoffman has been much interested in picture-writing, but he has also written upon a wide range of subjects in ethnology, archæology, and folk lore. His most important contribution is The Grand Medicine Society of the Ojibwas. W. H. Holmes is an artist, and his papers upon art in pottery and textile fabrics are among the most delightful in American archæology. Mr. Frank Cushing, as a village boy in western New York, was a hunter of Indian relics on the old village sites of the Iroquois; invited to the Smithsonian Institution, he was sent to New Mexico to study Pueblo life. The story of his life at Zuñi, his adoption, his initiation into mysteries, his conduct of an "aboriginal pilgrimage" to the Ocean of Sunrise, has been told and retold in magazine articles. At the establishment of the Hemenway Southwestern Archæological Exploration, in January, 1887, Mr. Cushing was placed in charge of its work and conducted it for two years, first in the Salado and Gila Valleys in Arizona, and later at Zuñi and its neighborhood. Two years of such work brought on a serious illness, from which Mr. Cushing is only now recovering. Some results of his work were published in the report of the meeting of the International Con-

DR. J. WALTER FEWKES.

gress of Americanists for 1888. From these years of experience Mr. Cushing has gained a stock of information, little of which has yet been published. At present he is again officially connected with the Bureau of Ethnology. We have only suggested the work of this bureau, and have not even mentioned some workers who have done good work.



ADOLF F. BANDELIER.

The collections made by Government workers go to three museums—the material in physical anthropology to the Army Medical Museum, that in ethnography to the United States National Museum, and that in prehistoric archæology to the Smithsonian Institution. The Army Medical Museum is a great collection, beautifully arranged. There is much material here to interest the anthropologist—many fine anatomical specimens; a wonderful series to illustrate the effects of gunshot wounds and their healing; a goodly number of monstrosities; most important of all are the skeletons and crania of North American tribes—more than two thousand of the latter.

Prof. Otis T. Mason is in charge of the ethnological treasures at the United States National Museum. He is a most systematic worker, and his card catalogue of references to literature of ethnography is well worthy of study. His annual summaries of anthropological progress are exceedingly valuable. More than any other American ethnographer he has carefully studied casing, display, and labeling. Where, as in the Eskimo series, the material from any given region or tribe is large in amount and varied in character, the arrangement is geographical. In general, however, the idea in the arrangement is to show culture history. This idea, so admirably carried out in Oxford, is scarcely found elsewhere in American museums. Some of the series are excellent; the development of the knife, the history of musical instruments, the history of fire-producing instruments are good. Some cases tell the story of a whole technique; thus the case of Guadalajara (Mexico) pottery shows by specimens and by small figures of potters at work every step in the manufacture. A point that

Prof. Mason particularly wishes to emphasize is the way in which primitive man works. Thus he is not content with securing the various fire-making machines, but he must have Mr. Hough demonstrate their use by actually making fire with them. So he has encouraged Mr. Maguire to illustrate how stone tools were made by making them. One is astounded by the vast collections in this museum—there is a bewildering wealth of material. All that is received is divided into three series—the smallest is displayed in cases; the second, much larger and wonderfully rich, is placed in drawers for students to use; the third is stored away for purposes of exchange. The museum publishes its own Transactions, in which many valuable monographs appear.

The Curator of Prehistoric Anthropology of the Smithsonian Institution is the Hon. Thomas Wilson, who at one time represented our Government in Europe. While there he had unusual opportunities for field-work in the famous localities, for study of museums, and for acquaintance with the workers. He has charge of a vast mass of material. Here are surface-found specimens from every State in the Union; the beautiful objects from the mounds which supplied the illustrations for Holmes's Art in Shell; the famous copper plates from the Etowah mounds; the Perkins collection of copper implements from Wisconsin; the Latimer collection of stone implements from Porto Rico; good series from Mexico, Yucatan, and Central America. Here, too, are the results of Dr. Cyrus Thomas's mound explorations and Warren K. Moorehead's deposit. A large space is devoted to Mr. Mindeleff's wonderfully natural and interesting miniature reproductions of the pueblos of New Mexico. There is, in fact, such a wealth of material that one is confused by its very abundance. Mr. Wilson has done a very wise and instructive thing in arranging "synoptical cases." These are table-cases, placed in two groups, one on each side of the entrance-door. In one is given, by a few carefully selected, carefully labeled, and illustratedly explained specimens, a synopsis of the prehistoric

MRS. ZELIA NUTTALL.

archæology of Europe, the arrangement following De Mortillet's classification. In the second group of cases a similar synoptical arrangement illustrates American archæology. As to the general collection, it is arranged strictly on a geographical basis, specimens from one State being together. Under this grouping a sub-classification according to form or type is carried out. One important work undertaken by Mr. Wilson deserves mention. From specimens in the museum a series of about one hundred has been selected, from which copies in plaster have been carefully made. One hundred such sets of casts have been prepared, and printed labels accompany them. These sets of casts are to be distributed to various institutions of learning in the United States, and considerable public interest in archæology should be the result.

Miss Alice C. Fletcher.

To complete our sketch we must refer to some individual explorations or work, and to anthropological periodicals. The Hemenway Archæological Exploration has been mentioned. This important work is supported by Mrs. Hemenway, of Boston. At present Dr. J. Walter Fewkes is the director of the work, which is centered upon the living tribes in the Moki pueblos. Dr. Fewkes is admirably qualified for the task, as he has had a thorough training in scientific methods of study. His field-work is excellent, and his own taste leads him to investigate the exceedingly interesting but difficult subject of the significance of the religious-dance ceremonials. Dr. Fewkes is perhaps the first scientist who has used the phonograph in taking down the religious music of a barbarous tribe. He has gathered considerable Zuñi music in this way, which Mr. Benjamin Ives Gilman has studied carefully. The results of this study as well as those of Dr. Fewkes's own work are published in the Journal of American Ethnology and Archæology, the official organ of the exploration. Work in the Southwest presents many attractions, and a recently organized expedition under, Mr. Warren K. Moorehead, is now in the field. This expedition is, we believe, the child of a

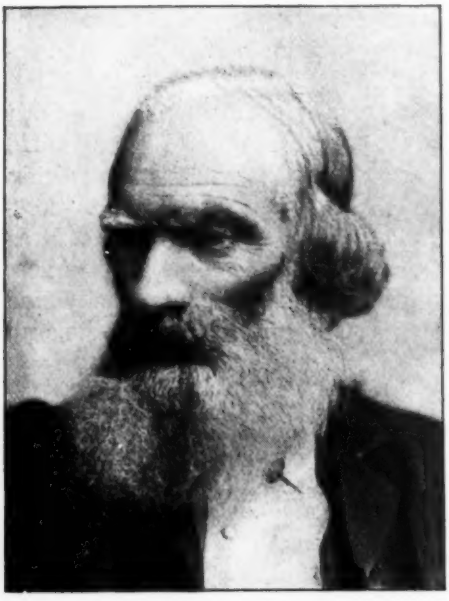
New York journal—the Illustrated American. Its object is a thorough study of the cliff-buildings of the Colorado district. Mr. Moorehead is one of the most enthusiastic of our young archæologists, and has already done admirable work in Ohio mound exploration. He was for some time with Mr. Wilson at the Smithsonian Institution, and has recently been making some remarkably successful excavations for the World's Fair. The Colorado expedition started February 29th, and is to be in progress for some months.

Mr. Ad. F. Bandelier, by parentage a Frenchman, is one of our most scholarly and critical students in that most difficult field —Spanish America. He has been markedly successful both in field-work and in study of the old Spanish records. Following the line of criticism so ably used by the late Lewis H. Morgan, Mr. Bandelier has destroyed much of the romance of Aztec and Peruvian history; but from the ruins he has reconstructed pictures of these most interesting societies that are lifelike, and far more in accordance with the genius of the American race than the old ones. His papers—at first published in the annual reports of the Peabody Museum, but latterly in the publications of the American Archæological Institute—are models of scholarship. Mr. Bandelier is now planning an important exploration into Peru-Ecuador. It is to be hoped that he may have no difficulty in finding the financial support that he needs.

Rev. S. D. Peet.

Two ladies are doing remarkable work in American anthropology. Mrs. Zelia Nuttall works in the same field as Mr. Bandelier. Although an American, Mrs. Nuttall lives at Dresden, Germany. She surrounds herself with an Aztec atmosphere; her library, one of the richest in Mexican works in existence, is cased in pieces of furniture whose forms and decorations are drawn from Mexican architecture. On all relating to Mexican archæology and history she is an authority. Two of the Peabody Museum monographs are by her—one upon a curious feather head-dress, the other upon the Mexican throwing-

stick, or *atlatl*. Recently Mrs. Nuttall had the pleasure of discovering at the old castle of Ambras (Germany) a fine shield of ancient Mexican feather-work. In the last number of the Internationales Archiv für Ethnographie she publishes an exhaustive and handsomely illustrated article upon the subject of feather shields from Mexico. In a recent visit to Florence, Italy, Mrs. Nuttall discovered in the library an Aztec manuscript with pictures. It turned out to be a treatise upon dress and ornament, and contains a text in Spanish letters. This, reprinted in fac-simile, with critical notes and an English translation, Mrs. Nuttall will present at the next congress of Americanists in October. Miss Alice C. Fletcher, although a fellow of Harvard University, assistant of the Peabody Museum, and employed in the Indian Bureau, is really a free lance in American ethnology. She is more—she is a firm friend of the Indian, and has shown herself so in many, many ways. As special Indian agent she has personally located five thousand Indians upon their own lands under the "Land in Severalty Bill." Her studies in sociology and religious beliefs among the Ponkas, Winnebagoes, etc., have been scientifically carried on. She is about to publish a work upon Ponka music, that has occupied much time and hard labor during several years back. All who know Miss Fletcher or who are acquainted with her work expect this work to be a most valuable contribution to knowledge.



Sir Daniel Wilson.

Three periodicals in America busy themselves with anthropology—the American Antiquarian, the American Anthropologist, and the Journal of American Folk-lore. The Journal of American Folk-lore is the organ of the American Folk-lore Society, and is under the editorship of Mr. W. W. Newell. The American Anthropologist has grown out of the Anthropological Society of Washington; it is coming to be more and more a representative journal of our national work in the field of anthropology. The American Antiquarian deserves a longer notice, because it is the pioneer journal. Mainly occupied with American archæology,

it has always been open to papers in other departments. From the beginning it has been under the editorship of the Rev. Stephen D. Peet, who has worked hard to put it where it now is, and who deserves hearty support in an undertaking which has never been a money success. Mr. Peet has himself been a field-worker and an original thinker. His field of labor is one that was for years left almost untouched, although none is more interesting—the effigy mounds of Wisconsin. Years ago Dr. Lapham prepared a work on the subject, which was very creditable for that time. Mr. Peet has gone over the same ground, and has resurveyed the groups. But he has done much more: he has surveyed many new groups, has made a careful study of the animal forms represented and of their attitudes, and has tried to work out their significance. The theories he suggests are certainly entitled to consideration, and his study deserves recognition and higher praise than it has yet received.

Nor are our Canadian neighbors neglecting anthropology. Sir Daniel Wilson's works, Prehistoric Man and Prehistoric Annals of Scotland, were training-books for the present generation of scholars. Very recently he has added an interesting contribution to a curious field in his little book Left-handedness.

Another veteran worker whom we love to recognize is Horatio Hale, who, half a century ago, went around the world as the ethnologist of the Wilkes Exploring Expedition. Of him Dr. Brinton, in the dedication of his recent little book on Races and Peoples, justly says, "His many and valuable contributions to linguistics and ethnography place him to-day among the foremost authorities on these sciences." Both, in advanced years, preserve the zeal for scientific progress, which shows itself in the planning and directing of anthropological investigations, in the founding of collections such as those of Toronto University and the Canadian Institute, and in the development of such students as David Boyle and Mr. Chamberlain. This archæological collection of the Canadian Institute at Toronto is a surprisingly rich and interesting one, and the annual reports regarding it are becoming valued contributions to archæological literature. In one of the more recent of these reports Mr. Chamberlain presents a valuable bibliography of Canadian work in anthropology—a long list of valuable papers. We only regret that we have not the space to refer to some of them and to their authors in detail.

Such, briefly sketched, is some of the work Americans are doing in the great field of anthropological science.

PHYSIOLOGY AND THE PREVENTION OF DISEASE.

By Dr. J. M. RICE.

THAT disease is far more prevalent than our knowledge of prevention justifies can hardly be doubted. An inquiry into the cause of this evil, as well as into the manner in which it can be removed, is therefore, in my opinion, not inopportune.

With few exceptions, that which is done at present for the prevention of disease is limited to improving the sanitary conditions surrounding the individual, in consequence of which two very important factors are left out of consideration: Firstly, that many diseases are caused by unfavorable internal conditions, which for the most part can be traced to imperfect development and improper modes of living; and, secondly, that exposure to unfavorable external conditions is not necessarily followed by illness, for the reason that the body itself offers a certain amount of resistance to the same. Unless, therefore, our efforts be extended to the prevention of diseases arising from internal causes as well as to increasing the power of resistance, they must to a considerable extent remain inefficient.

As the means employed for the purpose of improving the surrounding conditions are well known, it will be unnecessary to enter into detail here regarding them. The deleterious substances in the outer world are principally germs and other impurities of various kinds in the atmosphere and food. That diseases arising from such causes have considerably diminished during the past few decades, owing to the attention given to isolation, disinfection, antisepsis, sewerage, cleanliness, ventilation, etc., is unquestionable.

The remaining elements in prevention, namely, the regulation of the internal conditions and the increasing of the power of resistance, are so intimately connected that they are furthered by the same measures.

Although the conditions upon which the power of resistance depends are for the most part obscure, physicians agree that, other things being equal, an individual is strongly guarded against disease when he is in good health, and that resistance diminishes when the vitality becomes lowered. Now, in order that there may be good health, *normal functional activity of all the organs* is essential. By endeavoring to secure good functional action, therefore, we do all possible for increasing resistance to disease caused by unfavorable external influences; but, in addition, we obviously aid in the prevention of functional derangements which, together with their consequences, constitute a large percentage of all diseases.

But where shall we look for guidance if we desire to learn how normal functional activity can be attained? Naturally, to the science which treats of the bodily functions, *physiology;* and we shall see in a moment that by the application of physiological principles, not only will the organs be temporarily aided in the performance of their functions, but, if continued, good physical development, that condition upon which permanent health depends, will be secured. Therefore, physiology is, as well as bacteriology, to a certain extent a science of prevention, but, in our eagerness to catch and exterminate germs, it has been pushed far into the background, though so much nearer home to us than the latter.

That physical development is an important element in the maintenance of health becomes obvious when we consider that, other things being equal, an organ performs its functions in proportion to its strength; hence, if all the organs be well developed, all the functions will be thoroughly performed.

But good physical development is the result of adequate nourishment of all parts of the body, and such nourishment depends upon the proper performance of all the functions. That this does not lead us into an absurdity becomes evident when we consider that imperfectly developed organs may *with assistance* perform their functions efficiently, and physiology points out how this aid can be given. *In consequence of this help,* therefore, the organs develop and perform their functions properly with ever less assistance, and the condition of perfect health is gradually approached.

Now, if we assist the organs during childhood when they are weak, not only will much be done to secure good health during this period, but the age of maturity will be reached with a well-developed body, and good health, therefore, to a considerable extent assured through life. It is true that, under ordinary circumstances, a smaller body can be nourished, with weaker organs; but if as early as the sixth year a child begins to labor from five to seven hours daily the conditions are entirely changed. During childhood a large quantity of nourishment is required for growth alone, and, if a good share of this be expended in labor, it is clear that, unless something be done to compensate for this unnatural state of affairs, when the period of growth is over the body will be imperfectly developed, with very little chance of recovering the lost ground. When this is the case, the individual will be liable to be afflicted with poor health ever afterward; how often it now occurs is but too well known.

As to the means for assisting the organs in their labor, none is so powerful as *muscular exercise.* This agent not only plays an important part in the general nutrition of the system, having a

favorable effect upon all the functions which take part in the changes through which the food must pass before being converted into tissue, namely, digestion, absorption, circulation, oxidation, and assimilation; but it likewise aids in preventing derangement of these functions—that is, a large number of diseases. The following *résumé* of the effects of exercise will show that its value has not been overestimated:

First. Muscular contraction exerts a pressure upon the veins and lymphatics, thus pushing forward and facilitating the flow of venous blood and lymph to the heart. In this manner the excretion of the products of tissue waste is enhanced. These matters are washed out of the tissues by the blood and lymph, and after their return to the heart pass through the lungs, where the carbonic acid is given off, then through the general circulation, the remaining substances being eliminated by the skin and kidneys. When these matters, some of which are highly poisonous, collect in abnormal quantities in the system, they become more or less dangerous; even such mild symptoms as headache, drowsiness, and general lassitude in those who lead a sedentary life may probably, in many instances, be traced to their toxic effects. By muscular exercise, which hastens the elimination of these substances, therefore, many slight ailments, which, however, are sufficient to make labor burdensome and rob life of many of its pleasures, may be avoided.

Second. The circulation is controlled mainly by the action of the heart. When the activity of this organ is increased, therefore, the general circulation will be improved. Now, the heart is stimulated to action by the presence of blood in its cavities, and muscular exercise, by hastening the flow of venous blood, will be instrumental in sending more fluid through them in a given period of time, and consequently in stimulating the organ to increased activity. As many diseases, prominent among which are those of the abdominal and pelvic organs, are the consequences of congestion, and as good circulation does much for the prevention of such congestion, muscular exercise, by improving the general circulation both by increasing the activity of the heart and aiding in the venous return, will do much to prevent a large class of diseases.

Third. The respiratory center is increased in activity when the blood is more venous than usual—that is, when the amount of oxygen is diminished and the carbonic acid increased. Now, as an organ consumes more oxygen and gives off more carbonic acid when it is actively engaged in the performance of its functions, it follows that exercise exerts a stimulating effect upon respiration by making the blood more venous. When the activity of respiration increases, a larger quantity of oxygen enters the system;

and it has been calculated that this extra supply more than compensates for that expended in exercise—a circumstance which is readily understood when we consider that during muscular action more blood passes through the lungs, thus coming in contact with more oxygen. An increased supply of oxygen enhances the oxygenation of the food, thus directly facilitating the development of energy; and, besides, oxygen being a heart stimulant, the circulation will again be favorably affected.

Fourth. Assimilation becomes furthered by muscular exercise, for the reason that more blood passes through an organ during its activity, and consequently the latter becomes enabled to absorb more nourishment and lay by a larger quantity of reserve force.

Fifth. The blood, becoming more rapidly freed of its nutrient material by increased rapidity of assimilation, will be more ready to absorb such matters from the digestive organs. Improved absorption leads to more perfect digestion, and consequently muscular exercise aids considerably in the prevention of digestive disturbances. Further, when the digestion is enhanced, more food is called for. Increased appetite, together with improved digestion, absorption, oxidation, and assimilation, naturally exerts a marked influence upon the general nutrition of the system; therefore, exercise is a powerful means to the prevention of so many diseases caused by malnutrition.

Sixth. Muscular exercise by its direct effect upon the muscular system is the means not only of developing an active as well as a strong and healthy body, but likewise of storing up a large quantity of reserve force.

But, in order that muscular exercise may result in good physical development, *it must be carried on systematically for a long period*, and especially, for reasons already given, during the years of childhood. The *nature* of the exercise plays by no means an unimportant part in its efficacy. In order that all parts of the muscular system may be brought into play, gymnastics and calisthenics are indispensable. These exercises, however, should be supplemented by outdoor sports, such as games, rowing, swimming, skating, and the like, for two reasons: Firstly, the latter contain an element of pleasure without which that exhilaration which makes exercise doubly valuable is apt to be wanting; and, secondly, the air inhaled at the time is purer than that in closed rooms, an advantage which can not be overestimated.

But how can good physical development be placed within reach of all children? Only in one way, namely, *by the introduction of effective methods of physical exercise into schools*, for the reason that during the greater part of childhood systematic work outside of these institutions is, in the vast majority of cases, entirely out of the question.

In our search for means of preventing disease we have been led, as we see, beyond the province of medicine and into that of education. But the connection between these two fields, from our standpoint, extends much further, as we shall find. Though muscular exercise be carried to the point of perfection, and the surrounding conditions leave nothing to be desired, health is not assured; for, should the *expenditure of energy* be too great, there will still be marked interference with development. Hence, the *expenditure as well as the development of energy* must be considered.

Now, the energy is expended by the organs in the performance of their functions. Though ultimately derived from the food, its proximate source is, at least in great part, the tissues, which, by undergoing combustion, furnish the required energy; whether it be all derived in this way, or whether it be in part supplied immediately by the blood, is a matter which has no influence upon our problem. It is essential, however, to bear in mind that the amount of energy which can be developed in a given space of time is limited to the quantity of food digestible during this period, and, *if it be expended more rapidly than it is thus supplied, the functions are performed at the expense of the tissues.* If, therefore, we desire to guard the system against waste and allow the organs to develop properly, we must, as far as possible, *limit functional activity.* There are, however, only two functions over which we can exert a direct voluntary influence, namely, *the muscular and the mental.* But as there is ample compensation for the energy expended in muscular activity while there is none, in the physical sense, for that used in mental action, it is clear that if we desire to economize we must do so by exercising control over *mental labor.* That the energy expended by the brain during its activity is derived from the same source as that required for the performance of the other functions is, to-day, a generally accepted fact.

But, in order that it may not interfere with physical development, mental labor must be regulated both quantitatively and qualitatively.

In regard to quantity, the number of school hours must not be excessive; and introduction into school life should be gradual, so that the labor may be in proportion to the age and strength of the child. In Germany this rule is observed, the children beginning with about sixteen hours per week, to which two are added every year until the fifth or sixth, when the maximum is reached. The amount of work required at school, and in the preparation of lessons, likewise needs careful consideration.

From the qualitative standpoint the methods of instruction play an important part. When the laws of psychology are observed, the mind being treated in accordance with its nature, the

channels of least resistance are used, and the greatest amount of labor performed with a given amount of energy.

As long, therefore, as physical exercise is grossly neglected, and unpsychological methods of teaching remain in general use, disease must continue in abundance, though ever so many improvements be made in sewerage, ventilation, and disinfection; for, as our argument has shown, attempts at prevention will in great part remain ineffectual until good systems of physical and natural methods of mental development have been introduced into the schools.

WAYS OF THE OWL.

By FRANK BOLLES.

SINCE June, 1888, I have had in my possession for longer or shorter periods eleven live owls, including snowy, great-horned, long-eared, barred, and screech owls. I have also had opportunities of watching Acadian and screech owls in a wild state. In June, 1888, I secured two young barred owls from a hollow beech tree in a White Mountain forest. I have them still after three and a half years of happy companionship. During the first summer they were pets not easily petted. They used beak and claws fiercely and resented familiarity. I kept them in a large slatted cage in my barn, where they had plenty of air and light. They bathed freely and frequently. They ate largely of animal food. They were awake by day, restless at twilight, but profoundly quiet by night. They could see perfectly in bright sunlight, and better at night than most creatures. In the autumn I took them to Cambridge, where they were given a large cage in my cellar. During the winter I handled them more and more freely, beginning by using stout leather gloves, but soon stroking and rubbing their heads with my bare hands. They became more and more gentle, and I found that even when they nipped me with their beaks they did not attempt to cause serious pain. One of them, whose name is Puffy, injured his wing early in his captivity, and has never been able to fly. The other I keep clipped in one wing. In the spring of 1889 I began taking Puffy with me on walks. I found at once that he was wonderfully useful in attracting other birds. During the summer of 1889, the following winter, and the summers of 1890 and 1891 he was my companion on walks, drives, and trips in my Rushton boat. To a smaller extent I have taken his mate Fluffy with me, but he is of a less patient disposition than Puffy, and during a long walk is sure to hop from the stick upon which I carry him many more times than Puffy would in an equal period. In May, 1891, I secured a third baby barred owl from the same beech

tree. From the first hour that he was imprisoned he has shown an irritable temper. His whining as a young bird was incessant by day and not always suspended by night. Now, at the age of nine months, he whines whenever any one approaches him, and frequently makes violent assaults upon me when I enter the part of my cellar in which the owls are penned. Puffy and Fluffy during their first summer were quite timid, and Fluffy is an arrant coward now; but Prince Edward, as the new captive has been named, has never shown fear of anything living or dead, large or small.

Of two fully grown screech-owls which I owned, one in the spring of 1890, the other in the spring of 1891, little is to be said.

GREAT-HORNED. PRINCE EDWARD. PUFFY. SNOWDON. FLUFFY.

They were unhappy, and, although they ate well, both died from the effects of pounding their heads against wire netting in efforts to escape. These owls, when approached, stiffen their ears, make their feathers lie closely against their bodies, keep every joint and muscle rigid, and so nearly close their eyes that only an expressionless slit remains through which they watch the intruder. To the gentle caress of a hand they pay no heed. I have often taken one of them in my hand, laid him upon his back, and so carried him from room to room, and not been able to detect the movement of a feather. Let, however, the intruder retire, or let him take a dead mouse from his pocket and draw it by a string across the

floor, and Scops is himself again in a twinkling. The ears are lowered, the bright eyes open wide with a wicked glare, and the soft wings take the crafty and cruel little bird swiftly down upon the mouse. This habit of shamming unconsciousness appeared to be characteristic of the long-eared owl which was mine for a few brief hours in October, 1891. I handled him freely, but the closed eyes and rigid muscles did not move. I went away and watched him from a distance, and he was alert and making full use of his beautiful eyes.

Early in the summer of 1890 a friend sent me three young screech-owls. They were as odd little gray hobgoblins as could be imagined. Their temper, their voices, their appetites—all needed superlatives to describe them. They were sent to the White Mountains for the summer, and lived in a slatted box under the barred owls' big cage. They loved mice, birds, and fish, but did not take quite as kindly to raw liver as the barred owls did. For a week or more two of them were taken away from the third, and when they came back they no longer knew him as a brother. His life was made a burden to him, and one morning in August I found his body lying on the floor of their cage. They had removed nearly all his feathers and would probably have devoured him if I had not deprived them of the fruits of their unnatural crime. A few days passed and the two murderers quarreled over a mouse. In the frequent struggles that followed, one was killed outright and the other survived but twelve hours. My efforts to tame these young screech-owls were only partially successful. The murdered one had taken one or two excursions with me, and while I walked clung to a stick carried in my hand, or nestled between my arm and my body. If placed in a tree he served quite well as a decoy, although perhaps some species of birds did not take him as seriously as they did the barred owls when those intruded upon their breeding-grounds.

In June, 1891, I was presented with Snowdon, a full-grown snowy owl, which had been captured during the preceding winter. He was a dangerous-looking bird, with a temper and a trick of jumping for one's fingers. I clipped one wing and began by handling him roughly if he showed a disposition to fight. At the end of a week he learned to step upon a stick and cling to it while I carried him back and forth in the cellar. Taking him to the White Mountains, I gave up to his use a box stall in the northeast corner of my barn, and kept damp Iceland moss for him to stand upon, plenty of water for him to bathe in or drink, and a moderate supply of food for his sustenance. Although we had some warm weather, he was in perfect health throughout the season, and is now in excellent condition. At first I kept the barred owls away from him, fearing that they might murder each other,

but later experiments showed that Snowdon had no ill feeling toward the barred owls, and ignored them even when they stole his portion of the food. It is now six months since I turned them in together, and during the whole of that time the four birds have been on terms of quiet indifference.

About the middle of September, 1891, a Boston dealer sent me a mature great-horned owl. He reached my country place just in time to be sent back to Cambridge with the snowy and barred owls. Clipping one of his great wings, I placed him with the others in the 250 square feet of cellar space fenced off for them. Puffy prepared for war, Fluffy fled, Prince Edward regarded the stranger with indifference, and Snowdon and the great-horned formed an alliance at once. Three months have passed, and, so far as I know, no conflict has occurred. The older barred owls fear and dislike the great-horned. Prince Edward treats him with brassy familiarity, and Snowdon stays with him in the corner of the cellar farthest from the favorite perch of the barred owls.

GREAT-HORNED ON A STUMP.

Having introduced my characters, I will now compare them in several particulars. They arrange themselves, when I think of them as owls merely, into two groups—the brown owls and the gray owls. The great-horned, long-eared, screech, and Acadian owls seem to me much alike in disposition and their way of meeting man. They seem like kindred.

The barred and snowy owls, while quite different from the brown owls, are somewhat alike in temper. They show fight when approached, and are very alert. The barred owls make several different sounds expressive of various emotions. They snap their beaks furiously when warning an enemy; they whine when hungry; they make a soft, rather musical "o͞o" when meeting after an absence; they chatter with rage when pulling in opposite directions on the same bird or mouse; and they hoot when expressing the sentiments which make the domestic cock crow. While young they make a queer chuckling chatter when cuddled, and as the sound grows faint it suggests the music of a brood of chickens nestling under their mother's feathers. The hooting varies. In the August twilight I often hear the loud trumpeting

"hōō" uttered at intervals of half a minute or more by wild owls in the woods. The common hoot, which suggests to some ears feline music, is generally "hoo-hoo hoo-hŏŏ, hoo-hoo hoo-hōō," but I heard a barred owl this winter in a remote White Mountain valley say "hoo-ŏŏ, hoo, hoo, hoo, hoo, hoo, hoo-ōō." He was a conversational and inquisitive bird. By hiding in some evergreens and hooting to him I drew him little by little to the tree-top just above me.

Wholly different is the conversation of the snowy owl. His warning is sometimes beak-snapping, but oftener an open-mouthed, hissing "āh," which has a most menacing quality. He occasionally utters a shrill, whistling scream expressive of pain or the fear of pain, yet he makes it also when snatching a morsel of food held toward him. Thus far I have heard my great-horned owl make but four sounds: terrific beak-snapping; āh-ing quite equal to Snowdon's; a hooting which suggests wind sighing in a hollow tree, and taking the form of "whōō, hoo-hoo-hoo, whōōō, whōōō"; and a series of soft, musical notes, rolled from his throat when Snowdon comes too near his clutched breakfast.

My barred owls eat raw butcher's meat, mice and squirrels, bats, any kind of bird, hawk and crow included, fresh fish, lake mussels, snakes, turtle-meat, some species of frog, earthworms, some kinds of insects, and hen's or bird's eggs. They will not touch toads or the frogs which secrete an offensive scent. They rarely eat tainted meat or stale fish. Once they played for hours with a dead weasel, much as a cat plays with a mouse, but they did not eat any part of it. They catch living fish from a tank, and kill mice, squirrels, birds, frogs, and snakes; but they were at first greatly alarmed by a turtle, and a young hare running around their cage frightened them almost into fits. Puffy will face and put to flight a cat or a dog, but a pig is a terror to him. When Puffy was only six months old he caught and killed a two-pound pullet, yet in March and April, 1891, he roosted night after night on the same perch with an old Cochin hen which had begun her stay in his cage by giving him an unmerciful trouncing.

SNOWDON ON A SNOW-COVERED STUMP.

So far as I have been able to ascertain, Snowdon will not kill

anything, no matter how hungry he may be. He eats dead birds, mice, squirrels, fish, snakes, mussels, turtles, if opened, and butcher's scraps; but he will make no effort to catch or kill a squirrel, mouse, or snake, although shut up with them while hungry for a day or more. In one instance of this kind he ate a squirrel which he had allowed to live for twelve hours, as soon as it was killed and given to him. I have seen him drink once, and only once. If he bathes, it is a rare occurrence and done secretly. Early one morning in August, 1891, I heard a splashing in the owl's water-tank. It was about 3.30 A. M. Creeping to the cage, I peered in, and saw Snowdon shaking himself, as though he had just finished a bath.

His method of eating is suggestive of a carrion-eater. The barred owls are deliberate in their way of treating their food. They search for and crush joints and finny projections. In a frog they feel of every limb from end to end, and crunch away at the joints until they are mellow. They generally pull out the stiff wing and tail feathers, even in quite moderate-sized birds. Small snakes they swallow squirming. Snowdon, on the other hand, ignores live snakes, and his first act with dead food is to swallow it whole if he can possibly distend his throat far enough to let it pass. I have seen the head of a large rooster vanish down his throat bill foremost without his making any effort to crush it. Often a piece of food will stick in his throat and refuse to go down, in spite of vigorous jerks, jumps, and convulsive swallowing. It is then ejected and sometimes dropped altogether. With a large piece of meat or fish his method is different. Standing upon it, he snaps at it viciously and tears off small bits, in eating which he makes a smacking noise. Engaged in this way he is a disgusting spectacle. His head is poked forward, and the feathers upon it seem flattened. The hairy feathers around his beak are drawn back, and his red mouth is open much of the time. If disturbed while eating, he makes his shrill and extremely piercing cry. He is perfectly willing to be fed by hand, snapping at and bolting morsels of liver as fast as they are passed to him. He sometimes eats enormous quantities of food in a short time. He ate the whole of a full-grown bittern in twenty-four hours, and on another occasion a cooper's hawk placed before him at night had only one leg and a few feathers remaining in the morning. Like other owls, he ejects hair and bone pellets from his mouth.

The great-horned owl is not so ready to be fed. He prefers to eat while alone. Mice, however, are too attractive to be refused, and whenever held before him are slowly and quietly taken and swallowed. Other food he usually pretends not to see until I have left him. He seems ready to eat anything that the other owls like. I know that he has bathed at least once this winter, and, judging

by his plumage, he uses water freely. When given a cod's head or a large bird, he stands upon it and tears off morsels much as Snowdon does. His motions in doing this are sudden and his whole expression fierce and tiger-like. With horns slightly flattened and eyes glaring, he first plucks a piece of flesh from the carcass and then turns his head sharply from side to side to see whether any other owl dares to intrude upon his repast. My

SNOWDON. PUFFY. GREAT-HORNED.

barred, snowy, and great-horned owls all feed freely in the daytime. My screech-owls, on the contrary, usually waited until dark before devouring their food. One of them apparently ignored a live English sparrow for several hours while daylight lasted and the sparrow was able to see him, but when night came the sparrow was speedily caught, plucked, and eaten.

The feeling with which other birds regard an owl seems to be a mixture of curiosity, hatred, and fear. Curiosity impels them to approach, hatred causes them to make violent and abusive cries, while fear inclines them to wariness and prevents them from open attack upon their sphinx-like enemy. This feeling of the birds is general, almost universal, and is shared in a modified form by the smaller owls when brought in contact with large ones. To the chickadee or the warbler it makes no difference whether an owl is large or small; he is an owl, and that prompts inspection and vituperation. In several instances I have found Acadian owls in the woods in consequence of the racket made by birds scolding them. This winter, on the day after Christmas, I was walking through a spruce thicket in Albany, N. H., when the noise of nuthatches, Hudson Bay and black-capped titmice

and kinglets enticed me into the darkest part of the growth. The birds were greatly excited, and as I softly drew near them I saw that they were in a circle, all facing toward some focus invisible to me. I crept farther, and saw the tail of a small owl projecting from behind the trunk of a tree. Presently his tiny monkey face was screwed around over his back, and his timid yellow eyes fixed themselves upon me. His tormentors soon flew away, and after studying me attentively for some time the little Acadian floated off out of sight also.

The young screech-owl, whose death at his brother's hands I have already mentioned, irritated the birds of the forest and meadow in the same way. I placed him, one morning, upon a birch tree which was in use by a family of yellow-billed woodpeckers as a sap-drinking place. The sap-suckers made a great clamor on seeing him, and their cries called together all the birds which were within earshot. At least thirty individuals came, including kingbirds, cuckoos, catbirds, veeries, chickadees, four or

GREAT-HORNED AND SNOWDON.

five kinds of warblers, red-eyed vireos, song-sparrows, and two humming-birds. Having scolded for nearly ten minutes, they departed, leaving a sap-sucker and a humming-bird, which soon forgot the owl and resumed their usual employment of drinking the birch tree's sap.

Several times during the summer of 1891 I took my snowy owl out to walk. He weighs three and a half pounds, so the task of carrying him by hand upon an outstretched stick was rather a laborious one. The birds noticed him at once, and scolded as though he were of a species with which they were unpleasantly familiar, instead of one with which they were presumably wholly

unacquainted. Thrushes of various kinds, warblers, vireos, swallows, and sparrows treated him precisely as though he had been a barred owl. Once a grouse, with a family of chicks, confronted him boldly for a moment, while her brood scattered to cover. His conduct while at liberty was somewhat peculiar. He shunned the woods, and if taken into them, quickly made his way out. His left wing being clipped, his only method of advance was by clumsy leaps, or by a queer wobbling run, aided by outstretched wings. Whenever I placed him upon the ground, he would hurry away to a distance, and stop to pant with his wings dragging wearily at his sides. One warm morning I left him on an open pasture hill-side, and walked away to a belt of woods nearly an eighth of a mile from him. Concealing myself in the bushes, I watched him closely through my glass for an hour and a half. The time was nearly a blank. The owl, satisfied that I had gone, walked toward me about a rod and sought the shady side of a small patch of juniper. There he remained almost motionless for the entire period. Sometimes he turned his head and watched crows at a distance. Once or twice he glanced at the sky, and in one instance he followed with his eyes the flight of a small bird. Looking toward the sun did not seem to affect his vision. That he could see things at a distance was shown in several ways. When I came slowly from my hiding-place he saw me at once, and started jumping down the hill away from me. On another occasion I took him out in a pouring rain, thinking that he would go to the woods for shelter. He was content with standing under a small apple tree which gave him practically no protection, a fact which he discovered and sought to remedy by running to another tree of the same kind. Inactive, unable or unwilling to kill mice or squirrels, even when most hungry, silent, vacant in expression, cowardly, apparently stupid, the snowy owl, judged by my one captive, is a dull and uninteresting member of an unusually acute family. I doubt Snowdon's being a fair type of his species.

The barred owls are the particular abomination of other New England birds. They are courageous, keen of vision by day and in the twilight, strong, alert, quick, yet crafty. Their voracity makes them the terror of every nesting mother, the scourge alike of the forest, the field, and the meadow. Of their merits as decoys there can be no doubt. If taken while young and clipped, they are readily tamed and taught to obey simple orders. Mine have been invaluable to me in studying the birds of New Hampshire. When going for a walk, I take one or both of the older ones. Entering their cage, I extend a short stick toward and on a level with their feet, and say, somewhat sternly, "Get on." They generally bite the stick once and then step upon it, and

cling to it patiently while I carry them through any kind of country. When I wish to have them attract other birds I hold them toward a convenient branch and say, "Get off," which they are very willing to do. Then by whistles or cries I attract some bird's attention, and if it proves to be a titmouse, a woodpecker, a thrush, or some other excitable bird, the alarm is given, and from all quarters the neighbors come pouring in to join the tumult. Even while holding Puffy on a stick and walking with him, I have had birds attack him. Once a pair of solitary vireos followed me for some distance, one of them flying between my head and the owl three times, apparently not noticing me any more than though I had been a tree. A similar attack from a sharp-shinned hawk was more surprising than pleasant. Some species are less demonstrative than others, and seem to think silence and retreat wiser than vituperation. Cedar-birds, great crested fly-catchers, and scarlet tanagers are three species which seldom greet Puffy noisily. Game birds, as a rule, are too much afraid of me to remain near the owl, and the same is true of water-fowl. Loons have, however, shown curiosity on discovering Puffy, and sandpipers clearly dislike him. I tested this in an amusing way one day, by taking Puffy out in my boat to a point just to windward of a solitary sandpiper, and then setting him adrift on a small board. At first the sandpiper did not see him, but as the wind carried the placid owl nearer and nearer the beach, the tattler suddenly discerned him, and became stiff with astonishment. He faced the owl, his head poked forward and his body rigid, then with a wild cry he flew, rising from the water and passing over the trees, away from the lake.

Whip-poor-wills are not easy birds to watch at night, but they usually fly toward the owl, uttering excited *clucks*, and fly several times over it before going away to a distance. A mother night-hawk, with young, showed great courage and sagacity in dealing with Puffy. I placed the owl near her nest. She promptly flew down on the side of the owl away from her young, and fluttered in the grass as though wounded. Puffy hopped toward her. She flew a few feet, he followed, she flew a rod, he followed a third time. She flew three or four rods, and, as he hopped on, she rose and circled around him until, if he had seen her nest in the first place, he never could have remembered in which direction it lay.

The hooting of a barred owl in the daytime, or my imitation of the sound, almost invariably brings birds to the spot. Crows will come a long way in response to the hated call. So will blue jays, and several of the hawks and woodpeckers, hermit and Swainson's thrushes, chickadees, and a few other small birds, including the siskins in winter. Crows, in a particular region, soon learn that a barred owl implies a man in the same thicket, but for the first

two or three times, hooting will surely call them within short range.

Although game birds usually avoid the owl on account of my presence, a grouse with a large brood of young on one occasion showed much courage in watching Puffy. Her chicks scattered, but she remained in sight, whining and trailing her wings and doing her best to entice the owl away from the spot. Once she came within ten paces of him, her tail spread like a fan and her wings arched like an angry hen's. Puffy paid little attention to her, but seemed to be looking for the chicks which he had heard stirring in the leaves. Whenever he hopped she rushed into view, whining. She remained near by during the whole of twenty minutes that I spent in her domain.

In July, 1891, Puffy had a face-to-face meeting with a wild barred owl. Puffy was perched upon a stump facing a hemlock forest. Suddenly he became rigid and assumed a very unusual attitude for him, his head being thrust forward and his body flattened so that his breast rested upon the stump. Following the direction of his steady gaze, I saw a fine specimen of his race in the dark forest. He was as rigid as Puffy. How long they would have glared at each other I cannot tell, for it began to rain, and the stranger flew away.

The hearing of all species of owls known to me is marvelously keen; so keen, in fact, that I know of no way of testing it, since it is so much more acute than that of man. If owls have the sense of smell, I am unable to find satisfactory evidence of it. I have tried various experiments with them, hoping to prove that they could smell, but the results are all negative. They dislike putrid meat, but they bite it to ascertain its condition. They will not eat toads or frogs which yield an unpleasant odor, but they did not reject these species until they had tested them by tasting. They may be ever so hungry, yet they do not suspect the presence of food if it is carefully covered so that they can not see it. This test I have applied with the utmost care to the great-horned, snowy, and barred owls. The latter are shrewd enough to learn my ways of hiding their food, and when they suspect its presence they will search in the places where I have previously hidden it, pouncing upon pieces of wrapping-paper, and poking under feathers and excelsior with amusing cunning. I tested them with the fumes of camphor, ammonia, and other disagreeable and unusual smells, but they failed to show that they perceived them unless the fumes were strong enough to affect their breathing or to irritate their eyes. Finally, I put a cat in a basket and placed the basket between the two owls. They were utterly indifferent to it until the cat made the basket rock, when both of them fled precipitately, and could not be induced to go near the basket again. Although Puffy

will put a cat to flight when on his mettle, Fluffy is frightened almost out of his wits by them.

A Japanese toy-bird, made of a piece of wood and a few scarlet feathers, was eagerly seized by Puffy, indicating not only a lack of power of smell, but the presence of an appreciation of color. I have fancied that an appreciation of color is also shown by barred owls in their frequent selection of beech trees as nesting-places, by great-horned owls in their choice of brown-trunked trees, and by Snowdon in an apparent preference for gray backgrounds.

To this real or imaginary ability of the owls to select protective backgrounds is to be joined an undoubted power of assuming protective shapes. My great-horned owl can vary at will from a mass of bristling feathers a yard wide, swaying from side to side as he rocks from one foot to the other, to a slim, sleek, brown post only a few inches wide, with two jagged points rising from its upper margin. When blown out and defiant, his bill is snapping like a pair of castanets, and his yellow eyes are opening and shutting and dilating and contracting their pupils in a way worthy of a fire-breathing Chinese dragon. In repose he is neither inflated nor sleek, but a well-rounded, comfortable mass of feathers. The barred owls go through the same processes of expanding and arching out their wings when awaiting attack, and of drawing all their feathers closely to their sides when endeavoring to avoid observation. In one instance Puffy escaped from me in the woods, perched upon a small beech stump, drew his feathers into such a position that he seemed a mere continuation of the stump, closed his feathered eyelids until only a narrow slit remained for him to peep through, and stayed perfectly stiff for an hour while I hunted for him high and low. I passed by him several times without bringing my eyes to the point of recognizing him as a living thing. This power is shared by the screech-owl and the long-eared owl. The plumage of the snowy owl is so solid that he seems more scaly or hairy than feathered. He does not, so far as my specimen shows, expand and arch his wings. Instead of standing straight and becoming slim and rigid, he crouches and flattens himself when seeking concealment. I can imagine him in his Labrador wilds crouching thus amid a waste of junipers and reindeer moss, and baffling the eye which sought to detect him there.

The control which owls have and exercise over their feathers is not limited to moments when they wish to appear terrible or inconspicuous. They seem to ruffle them or smooth them, expand them or withdraw them in queer ways at pleasure. The barred owls, when stepping stealthily across a floor after a dead mouse drawn by a thread, tuck up their feathers as neatly as a woman hold her skirts out of the mud. When eating, the feathers nearest the mouth are pulled aside in a most convenient way.

When wet, the feathers seem to shake themselves as well as to be shaken by motions of the body, head, and wings. My wife, in making a water-color sketch of Snowdon, complained that, although she could not see him move, he changed his outline a dozen times in an hour.

The owl's eye is his most useful member. The popular belief that the owl is seriously blinded by light is almost wholly unfounded, at least so far as the species of which I am writing are concerned. When a man approaches an owl in broad daylight the owl, in nine cases out of ten, will close his eyes, and so appear sleepy. As I have already explained, this is an effort to escape notice by the assumption of a protective shape. That it is not due to any dread of light or inability to see is shown by the following instances of perfect seeing by owls in bright daylight: Walking through a Cambridge road in March, 1891, I saw an Acadian owl perched on a willow limb about fifty feet from me. His plumage was stiffened and his eyes nearly shut. I approached him and slowly raised my hand toward him. Suddenly his eyes opened wide and glared at me. Then the soft wings spread and he fell forward upon them, and flew toward the sun to a distant perch. The Acadian owl already mentioned as having been seen in December, 1891, in the spruce forest of the Swift River Valley, watched me keenly, and swung his small head around after the manner of owls, trying to see me clearly from more than one point of view. The screech-owl which I first owned, although shamming sleep one morning when I entered the room where I kept it, pounced upon a dead mouse which I let fall upon the floor, and flew off with it before I realized what had happened. One of my three young screech-owls when only two months old tried to catch a sap-sucking woodpecker which had perched near it in the sunlight on a dead tree. My snowy owl, as I have already stated, watches birds flying across the sky at a distance, and once saw me as I slowly emerged from the woods an eighth of a mile from him. Great-horned owls are well known to be active by day, and not inconvenienced by sunlight. The barred owls, however, exhibit the most marvelous powers of sight, and their eyes may well be called telescopic. In dozens of instances Puffy has seen, and by his fixed watching of the sky has called my attention to, hawks flying at so great a height that they were well-nigh beyond man's vision. More than this, he has on two or three occasions seen a hawk approaching in the upper air when my eyes, aided by a fairly strong glass, failed to see the bird until it drew nearer and grew large enough for me to detect it as a mere dot in the field of the lens. My eyes, by the way, are rather stronger and more far-sighted than the average. If the bird thus sighted by Puffy is a hawk or an eagle, he watches it until it is out of sight. If it

proves to be a crow or a swift he gives it merely a glance and looks away. The barred owls frequently look at the sun with their eyes half-closed for fifteen or twenty minutes at a time. Why they do it I am wholly at a loss to explain. I am in doubt as to how much Puffy can see at night. I once held a cat within a few inches of him in the darkness, and he did not stir. Had he seen it he would certainly have moved and probably snapped his beak. In August, 1891, I let him out after dark on a patch of closely cropped grass where the dim light enabled me to see him when he moved. I went to the nearest tree and seated myself with my back against its trunk and my legs stretched out before me. Half an hour passed, Puffy scarcely moving except when a bat flew over him, and I keeping perfectly motionless. At last he came toward me, slowly, a yard or two at a time. When he was within a few feet I could see his outline quite plainly. One more hop brought him to my knee, upon which he jumped. Instantly he bounded into the air and made off, unmistakably frightened. He had no idea that he was going to strike a leg and not a log; yet if his eyes had been much keener than a man's he would have seen not only that my clothes were not wood, but that I was leaning against the tree-trunk watching him. In several instances I have called wild barred owls at night and have had them alight in tree-tops close above me. I could see them against the sky, but apparently they could not see me sitting among the brakes and bushes below them. Once with an owl thus above me I imitated the squeaking cry of a wounded bird. I wished I had not, for the owl's ghostly wings brushed past my face so closely that I fell back into the bushes, fearing that he would strike at me again.

The memory of my owls is noticeably good. Puffy and Fluffy, the two barred owls which I have had longest, remember their favorite perches from season to season, and resume their chosen roosts after months of absence. In one instance Fluffy, on his return to Cambridge after four months in the mountains, flew the length of the cellar, expecting to strike a perch which had been removed, and, failing to find it, fell to the floor. It is only necessary for me to bring a box-trap into the barn for Puffy to come to the front of his cage, eager to be given a chance to catch the chipmunk which past experience leads him to believe is in it. Similar eagerness is shown in winter, when I bring a paper parcel into the cellar, the owls knowing so well that it contains food that they will tear it open themselves if I do not open it for them. If the bundle is brought in without their knowledge and thrown at random upon the floor, they do not find it, and will leave it for days untouched. Puffy does not like going out in my boat. If he finds that I am taking him to the shore near it, he invariably jumps off his stick and tries to hide in the bushes. Snowdon

knows a piece of cloth which I have used to throw over his head when I have wished to handle him, and the sight of it is enough to cause him to make strong efforts to escape from his cage. All three of the barred owls hide their surplus food, and remember where they keep it. Snowdon, on the contrary, sometimes stands over portions which he is not ready to devour, letting his feathers sink down so as to cover them. Puffy not only understands the commands "Get on" and "Get off," but he knows his own name, and generally answers when I call him by giving a friendly "clap, clap" with his beak. He has frequently revealed his position to me by this answer when I have lost him in the bushes, tall grass, or at twilight. That he especially, and all my other owls to a less degree, know me and distinguish me readily from strangers, is, I think, undoubtedly a fact. Thus far I have been unable to see that any of the owls have a clear notion of time, except as indicated by the coming or going of daylight. The digestive workings of owls are extremely economical. In summer the birds have enormous appetites, and become frantic with hunger if not fed every forty or fifty hours. In winter, on the contrary, the mature birds fast for a week or more without complaint. During the winter of 1889–'90 I could not ascertain that Fluffy ate anything for more than a month—that is, from Christmas-time until the first week in February. Throughout this period he seemed well, though inclined to keep quiet and to stay in the darkest corner of the cellar. When fed regularly and amply, all the species of owls with which I have had any experience cast from their mouths egg-shaped "pellets," composed of the bone and hair, fish-scales, and feathers which remain in their stomachs after the digestion of the more nutritious parts of recent meals. This ejection is accomplished easily and quickly, with very little visible muscular action. It usually, or at least often, takes place at the moment when the owl has another hearty meal in view. The owls' furnaces burn nearly all that goes into them. Considering the amount of fuel put in, the extremely small amount of ashes is wonderful.

In disposition my owls vary widely. The barred owls are—as owls go—remarkably sweet-tempered and gentle. I never have seen one offer violence to another, even when two were struggling over a morsel which both were determined to have. Snowdon is sullen, stupid, cowardly, and treacherous. The great-horned has a temper, but he generally keeps it concealed under an air of dignified reserve. My screech-owls, when not shamming sleep or death, were irritable, quarrelsome, and ferocious. Between my three-barred owls there are individual differences in disposition, which are readily learned but not easily described. They stand out distinctly in my mind as three characters, just as three chil-

dren or three horses would be distinguished when I thought of them. I feel as much attachment for Puffy as I possibly could for an intelligent and faithful dog. His crippled wing has probably made him unusually docile and tractable, but, whatever may be the cause of his goodness, he certainly is a model of patience, placidity, and birdly virtue. This, in combination with pluck, which leads him to charge upon and vanquish dogs, cats, and domestic fowls, and a magnanimity which enabled him to roost for weeks alongside of an old hen, will make him worthy of owlish canonization when in good time he is gathered to his fathers.

ALMOND CULTURE IN CALIFORNIA.

By HENRY J. PHILPOTT.

DURING the fiscal year ending June 30, 1890, the American people imported 5,715,858 pounds of almonds, valued at $813,278. The value of all other nuts imported was $800,376. I confess my surprise at this fact, that we spend more money for almonds than for all other imported nuts put together. It would not be so surprising if this were the cheapest of our imported nuts. But, on the contrary, it is the highest priced, not only in the countries of exportation whence we draw our supplies, but still more so to the consumer in this country, on account of the higher import duty. The duty on almonds is five cents a pound if unshelled, and seven cents and a half if shelled. The highest duty on any other nut is three cents on filberts and walnuts.

The average import price of the almonds was fourteen cents and a quarter, and of the filberts and walnuts 5·7 cents. The almonds imported were almost exactly half shelled and half unshelled, which would make the duty average six cents and a quarter; and so, adding the duty to the import prices, the prices in this country, duty paid, were 20·5 cents for almonds and 8·7 cents for filberts and walnuts. Thus our preference for the almonds seems to be conclusively established, in spite of the fact that our imports by weight of filberts and walnuts were nearly double those of almonds.

The home production of all these nuts is still so small that we have no reliable statistics of it. California produces both almonds and walnuts, but in small patches only. The southern end of the State has a considerable walnut belt, but the almond orchards are widely scattered. The area suitable for almond culture is confined to small spots distributed over the whole length of the State. It is doubtful whether there is enough of it all told to supply the

American market. What there is of it, however, is rapidly filling up with the trees. Not more than half of those already set out are now in bearing. So it may not be many years before the California almond-grower will be able to depress a market which he can never hope to wholly supply, even with the burden of a high protective tax of five cents a pound heaped upon his foreign competitor.*

For the past year I have myself been an almond grower, in a small way, my total product being almost exactly one car-load. The purpose of this paper is to describe the processes by which the favorite nut of Americans is produced and made ready for their holiday tables.

To begin at the beginning, the almond is strictly a budded or grafted tree. A seedling apple, peach, cherry, or plum is sure to be good for something and marketable at a fair price, though it may be far below the grafted stock in quality and productiveness. The seedling almond may, like other seedlings, be an improvement, but it is very apt to be utterly worthless and unsalable, and may be deadly poison. It is as if its evolution were so recent that its type is not well set, and its tendency to atavism, or "breeding back" to older types, quite strong. This inclination to "sport" shows itself even in budded and grafted trees. All except the oldest trees on this ranch were planted and budded on the ranch, under the careful supervision of the owner. In selecting the buds and scions he not only paid strict attention to varieties, but took care to cut from none but the most prolific bearers of the best nuts among the tested trees of each variety. In spite of all his care, we have some interesting sports. There are trees that never bear at all; others bear worthless nuts. One yields a nearly perfect peach-pit inclosed in a nearly perfect almond drupe. And the four named varieties, though amply distinct when fairly represented, now and then shade into one another so gradually that the most experi-

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* The table on page 314, Internal Commerce of the United States, 1890, estimates the "shipment" of almonds as follows:

Year.	Pounds.
1885	1,050,000
1886	600,000
1887	500,000
1888	450,000
1889	600,000

Whence or whither the "shipments" were made is not stated. The connection indicates that they were from the eight leading fruit and nut shipping points in California. The figures look like guesses, and no clew is given to the amounts shipped from the other points to San Francisco, to be reshipped and thus counted twice in the table, which does not include some important almond-shipping points; and would not include my 15,000 pounds sent from a point not named in it direct to Chicago.

enced pickers have difficulty in deciding which box to empty their baskets into.

Of the many varieties of almonds four only are cultivated on this ranch, and their most important difference is in the weight and hardness of shell. None of them is a hard-shell, but the standard is a rather hard soft-shell; the Languedoc is the regular soft-shell, so quoted in the market reports; the paper-shell is the nut regularly quoted as "paper-shell"; and the California paper-shell is a new and very distinct variety which originated within a mile of here, and has made this ranch famous among the nurserymen of the State. The trees grown from its buds and scions probably number at this writing half a million. At any rate, enough has been cut from it to produce a far greater number. It was a purely accidental seedling, not a premeditated hybrid. But its good size, plump kernel, extraordinarily thin, light shells, sweet flavor, and agreeable appearance have won its way in the markets; and sold alongside of other nuts, hard-shell, soft-shell, or paper-shell, in San Francisco, New York, or Chicago, it brings the highest price of all by two or three cents a pound. It is the truest of all to type, and most distinct in the form of the tree. Mr. Morrison at first set out a twenty-five-acre orchard entirely of this variety. But, being disturbed by reports that it had proved a shy bearer, he sawed off three fourths of the trees and grafted in the better-known varieties. The new almond certainly has not borne so well as the others since I have been familiar with it, and I am afraid the difference in productiveness offsets the difference in price. Otherwise the California paper-shell would be a valuable contribution, strictly American, to the improvement of the almond; and Mr. Webster Treat, who has tried it on a larger scale than anybody else, claims in his paper, read before the State Board of Horticulture, that it is the hardiest and most prolific as well as the most salable almond grown. He confidently predicts that it will drive the foreign almond out of the market.

The almond is an unpruned apple tree in size and shape, and in smoothness and color of bark; a peach tree in foliage and green fruit. The leaf is so exactly like that of the peach, to which it is most nearly related, that the casual visitor can not distinguish them. The same is true of the fruit in a very green state. The drupe is a peach in taste and smell, both green and dry. The almond is quite commonly grafted on peach stock, though some prefer the almond stock on account of its alleged greater hardiness and longevity. An almond orchard in bloom is a thing of beauty. The first one I ever saw was the one immortalized in the story of Ramona, and it happened on Washington's birthday. The date shows what an early bloomer it is. First of all the fruit

blossoms of spring comes the showy almond, a dense mass of white with a "hint of a tint" of pink in it.*

The cultivation of the almond is easier than of any other tree, unless it be the prune. The orchard is plowed and harrowed once or twice a year, and then the weeds are kept down in any way the farmer chooses. The amount of work required to do this depends on the weather, and is just the same for the almond as for any other tree. But the almond tree, like the prune, is never pruned in this region. Like the prune, the fruit is never thinned on the tree, as the peach and apricot must always be, to produce a crop of good fruit. The heavy pruning and thinning required every year on our peach and apricot trees is a great expense, the thinning alone often costing fifty cents a tree, for an average of the whole orchard. Aside from stirring the soil and killing the weeds, a dozen apricot trees take more care and labor than a dozen acres of almonds. This is the consideration that makes almond-growing popular. Equally important is the fact that thus far the almond has no parasites, such as scales, moths, etc., while almost every year adds a new recruit to the insect enemies of other fruits. Our peach-growers are put to the expense of buying costly machines for spraying their trees, and insecticides with which to spray them. Insecticides cost money, and spraying costs time and labor. If the wash is strong enough to kill the scale, it is apt to kill the new wood of the tree—a very serious matter in the case of the peach, whose fruit is all on its last year's growth of wood. Still, the spraying must be done every year, and may even be enforced by law in California. All this trouble and expense are saved to the almond-grower, whose only insect enemy is the red spider, a semi-occasional visitor easily got rid of, and not formidable if left unhindered in his work.

First to bloom in the spring, the almond is last to mature in the fall. The whole spring and summer long it hangs there, a green peach for all the world, and after the first few weeks never increasing in size or changing in appearance. The seam is deeper than in most peaches, but not deeper than in the ripe apricot. Late in August this seam will be seen to have opened in a few of the earliest. The grower's anxiety now reaches its climax. Will his almonds open and remain open until harvested, or will the drupe remain closed, or only partially open and then close tight again? The whole profit of the crop may depend on this question. It may cost half they are worth to pick and husk them.

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* The writer in the Encyclopædia Britannica combats the ancient tradition that almond blossoms are white. He says they are pink. As I have seen them it is more proper to call them white than pink, though the whitest contain a suggestion of pink, and some varieties show it so plainly as to be distinguishable at considerable distances.

Just that thing happened this year to my nearest neighbor, and to several neighbors; while the nuts on this ranch opened better and husked easier than ever before in the whole course of its thirty years of almond-growing. The result was, that our pickers earned a dollar and a half a day picking at half the cost per pound incurred by our neighbors, whose men earned a dollar and a quarter a day.

The nuts are knocked off the trees with long poles. Where they have opened nicely they are allowed to drop on the bare ground, and are husked as they are picked up. The picker's delight, if he is working by the bushel or box, is to see the ground covered with nuts that the stroke of the pole and the impact against the clods have completely husked, so that he has nothing to do but throw them into his basket. He is lucky indeed if half of them come out that way. Those that do not are husked with the fingers. The new paper-shell above described is one of the freest, and its drupe often falls off spontaneously before the picking season, leaving the naked nut hanging to the tree. But the nut so free from its drupe clings tightest of all to its tree, and is often quite hard to knock down without injury to the branches. Otherwise the saving in its harvest expense would be quite an important point in its favor.

In the best of seasons there will be a large part of the crop so badly opened as to require a different process. A canvas is spread under the tree for the nuts to fall on. When all are knocked down, the canvas is rolled up and with its load of nuts carried to any spot near by where it is convenient to heap together the harvest of several trees. A simple table of loose boards is made, and around it gather the pickers. One of the party rubs the nuts to loosen the drupes, and the others husk. The rubber is an extremely simple machine, exactly like a washing machine in principle. Practically it is two old-fashioned wash-boards rubbed together. In appearance it is a flat-bottomed pig-trough, six or eight feet long and open at one end. Across the bottom inside, pieces of lath are tacked an inch apart, and thus the lower wash-board is formed. The nuts are scooped into it, a few pounds at a time, and a shorter board, likewise ribbed crosswise with lath, handled like a flatiron or a plasterer's trowel, is rubbed over them by hand, loosening their husks and pushing them along to the open end of the trough, where they fall into a box and are heaped on the table, to be now easily husked. It is a cheerful thing to see the assembled pickers seated under the shade of a tree, making their fingers fly and heaping up their boxes with the precious harvest. The damper on the meeting is the fact that almost invariably the pickers are Chinamen. Their gay chatter might as well be that of monkeys, for all the sense you get of it.

At many kinds of work white men are more profitable to employ than Chinamen, though they demand much higher wages. At picking almonds the Chinaman is preferable at the same wages. Fewer nuts escape his keen eye to be left on the tree or under the clods. He can pick more in a day, and with less damage to the tree and the nuts.

In large orchards a more complicated but still crude and unsatisfactory rubber is sometimes operated by horse or steam power. But the nuts and drupes must still be separated by hand, and probably always will be. The drupes are mostly only loosened by the machine, many of them not even that, and but few of them entirely rubbed off. This last might be done by machinery in the case of quite hard-shelled nuts. But more force is required to remove the drupe than to break the shell of a large portion of the crop. In some orchards every year, and in many orchards this year, the only way to market the almond was to crack it with the drupe on and sell the kernel. Others who did not deliberately crack were obliged to rub so hard that many of the kernels came out, and at the close of the harvest they had barrels of them to sell as shelled almonds. The price per pound is greater than of unshelled almonds, but my neighbors say that the addition to the price does not make up for the weight of shells thrown away, to say nothing of the extra labor and expense of cracking.

Where the picking was done by hand, and paid for by the box, it cost this year, in this vicinity, seventy to ninety cents a box. The box used is what is called the large-sized free apple-box. That is, it is the box which holds an honest bushel, and goes with the apples when they are sold in the market. The first boxes I got from the factory were free apple-boxes, and I supposed that was all right and sufficient, until the Chinese foreman of our band of pickers brought out the box he had used in former years, and I saw that mine were smaller—just enough smaller not to arouse suspicion in the breast of the final consumer when he buys apples by the box, and at the same time to save the middle-man, who buys by the pound and sells by the box, a few pounds in each box he sells. He prefers that the producer should ship his fruit in these dishonest boxes, just as the San Francisco butter dealers, who buy by the pound and sell by the roll, caution the farmers not to put quite two pounds in a roll. So I found that my apple-boxes were short-weight boxes, and were losing me the cost of picking about three pounds out of every box of almonds picked; and that this loss would in one season cover, several times over, the price of the boxes. I put this part of the story in for whatever it may be scientifically worth, as a contribution to the study of commercial ethics. I bought the larger-sized bushel boxes as

quickly as possible. It cost me one dollar and fifty-six cents to find out the difference between a bushel of apples and a bushel of apples.

Picking and husking the almonds cost us exactly fifty dollars a ton, and our neighbors all the way up to twice that. Outside of my own family we employed a varying number of Chinamen, up to nine. The task lasted from the 18th of September to the 28th of October. The boxes picked each day are gathered in the evening and conveyed to the drying-yard, where the nuts are sun-dried for a few days. Then comes the bleaching, which is done with the fumes of sulphur, and requires care and some experience.

The bleaching-box is built in various fashions, but covered with tongued and grooved boards and in other ways made tight, so as to confine the sulphur-smoke as much as possible. In common orchards it is about six feet square and six or seven high. It is a complete inverted box, and often movable. The drying-trays are slid in on cleats like the draws of a cabinet. Almonds, being dried before they are bleached, are sprinkled or sprayed with clean water just before sulphuring, the moisture being necessary to make the sulphur do its work of bleaching. The proper quantity of sulphur for one bleaching is put into a pan, ignited, and set inside the bleaching-box. The doors are closed tightly, and left so until the sulphur is all burned. The almonds are then taken out and dried again for a few hours, to remove the moisture sprayed upon them before bleaching.

If they come out bright and evenly bleached, the grower's heart beats more quickly. He knows that it is the color that sells his almonds. Consumers may growl as much as they please, and preach on the sin of poisoning their fruit with sulphur-fumes, but they will always buy the poisoned (?) fruit and give a much higher price for it. They may pat the honest grower of unbleached fruit on the back, but trust them never to give him a penny's worth of encouragement in the market. To-day my paper quotes unbleached apricots at two to four cents a pound, and those that are bleached, or "sulphur-poisoned," at five to six and a half cents. All these prices preclude living profits. Who knows how many growers of unbleached fruit this year's ruinous prices will drive off their farms and out of business, to make room for a like number of sulphur-poisoners? And, going back to the apple merchants and butter dealers, we must admit the full force of the same apology for their crookedness.

But aside from the fact that the fruit-grower is held, much against his inclination, by his final consumers to *his* questionable trick of trade, the question is still open whether it really does them any harm. Sulphuric acid, like many poisons, is a medicine in proper doses. Does a tablespoonful or two of well-

bleached peaches, taken at meal-time, contain a poisonous or a medicinal dose of the acid? Remember, they are not sulphured *ad lib.* The consumer and the middle-man set the bounds. A distinctly susceptible sulphur taste hurts the peach in the market, and reacts on the grower. He is obliged to learn the art of securing a thorough bleach without the sulphur taste. To do this he must have the right kind of sulphur, and a very tight bleaching-box properly arranged inside; and he must know how much sulphur to put in, and how long to leave his fruit exposed to its fumes. The most experienced of my neighbors still differ widely on all these details. But I am convinced that, with proper facilities and proper skill and care, the bleaching may be made to entirely satisfy the eye of the consumer without injuring the rest of his body. I confess I should like to be still better satisfied on the point. But I console myself with the reflection that sulphur-smoke is a famous disinfectant, and must render the fruit-eater less liable to all those diseases originating in germs, either microscopic or otherwise. Who knows but that a thorough scientific investigation, bacteriological as well as chemical, would prove the sulphur-poisoner to be, on the contrary, a conservator of the public health?

But whatever guilt the fumes of sulphur fasten upon the fruit-grower, the almond-grower is clear of; for he does not sulphur his fruit at all. What he sulphurs is but the shell that is thrown away—that is, if he does his work properly. If he sulphurs while the nuts are green, or wets them too much just before sulphuring, the fumes may penetrate to the kernel; especially of very soft-shelled or paper-shelled almonds. But he gains nothing by it, not even in the appearance of his nuts, and does it from ignorance or inexperience rather than from policy. I tried this thoroughly, and by watching closely the result of each experiment was able to improve on the best advice my neighbors, old in the business, could give me. First, our old bleacher being too open, a new one was built. Then the almonds were made a little drier than they need be to go to market. Then the water was put on in the finest spray attainable, so that the nut was slightly but evenly dampened, but little if any more than enough to make up for the overdrying. Then the time of exposure to the fumes was regulated, not by the watch, but by the quantity of sulphur put into the pan, so that, whether we bleached in the daytime and took out one bleacherful to make room for another, or went to bed at night leaving the bleacher loaded and the sulphur burning, the nuts always got the same dose and no more. We kept on until we found the minimum of moisture and the minimum of sulphur that would do the business.

The nuts came out of the bleacher looking beautifully, all the

more so by being laid out in the drying-yard in rows or squares alongside of the black, ugly things not yet bleached. They never look so pretty afterward, for the sunlight required to dry off the moisture artificially put on blackens them to a certain extent. Here we got the advantage of not moistening too much. Our overdried nuts absorbed part of this moisture, and they could soon be removed from the discoloring influence of sunlight, and the curing finished in the shade. Manipulated in this way, the kernel of the finest paper-shell can not be hurt by the sulphur.

And this leads us to the observation that, as a rule, the harder the shell, the whiter the almond bleaches. This rule does not hold always and absolutely, for, while no paper-shell approaches the mere soft-shell in whiteness, the whitest of our paper-shells is also the softest-shelled—namely, the new "California." But while the market pays more for the darkest paper-shell than for the whitest soft-shell, the tourists who visit our yards are always most attracted by the "Standard," the hardest of our soft-shells, because of its showy whiteness. In the market it brings about two thirds the price of our black, old-fashioned paper-shell—that is, in the San Francisco market. But just here I had one of my most interesting experiences in almond-growing. I sent fair samples of each of our four varieties to San Francisco and also to Chicago. I was struck by the grotesque difference in the relative prices quoted from these samples. Thus, in cents per pound:

Variety.	San Francisco.	Chicago.
California paper-shell	14	18
Common paper-shell	12½	12
Languedoc	10½	15
Standard	9	15

The tawny skin of the common paper-shell, easily cracked by twisting in the fingers and yielding a large weight of kernel in proportion to weight of shell, was too much for Chicago, and it was quoted away below the heavy-shelled, hard-shelled Standard, requiring the use of the hammer, or the clumsy nut-cracker, and its weight consisting largely of waste shell.

If any of these varieties had a kernel suitable for the confectioner or the baker, and he bought them unshelled, he could afford to pay considerably more for the paper-shells; for he would be paying for little else but kernels, and these would be easily extracted. However, the kernel used in candies and cakes is that of the imported Jordan almond, in San Francisco as invariably as in Chicago or New York. It is imported shelled, and is longer and smoother than anything we have yet produced. It comes from Malaga. Those who buy nuts by the pound for the table, or to

carry in the pocket, would save money by paying a little more for paper-shells, to say nothing of convenience in cracking—especially as a pocket nut. Those who buy them for children inclined to use their teeth as nut-crackers would save something worth more than money. The child who disobeys and clandestinely cracked his almonds that way would not be damaging his teeth as much as if chewing a hard crust of bread or a dry toast. On the other hand, many persons, after their attention has been called to the subject, like, or think they like, the flavor of the harder-shelled Standards and Languedocs better than of the paper-shells; and *de gustibus non est disputandum.* The writer hereof has no preference. He never did eat almonds, nor any other imported nuts except Brazil-nuts, when he could get the native nuts of the Mississippi Valley.

If this is due to early associations, the almond would by the same token be the favorite nut of the younger generation of California almond-growers. They had no eatable wild nuts, their native walnut tree, transplanted to their homes for its beauty, bearing a worthless nut. The almond, of all their crops, was best adapted to cultivate and felicitate home life. They harvested it themselves, knocking the nuts off the tree in the daytime, husking what they could, and carrying the rest into the house to be husked by all the nimble fingers of the large, old-fashioned families at night. Prices were high then, and every pound husked meant twenty, twenty-five, or even thirty cents. With such prices, never-failing crops, and little or no cash expense, it is no wonder that almond-growing became popular, nor that the solidest farmers attribute their present comfortable circumstances to almonds. Well may they turn from these degenerate dime-a-pound seasons of more than occasional failure, when the inevitable Chinaman, whom the Exclusion Act has exalted into a grasping monopolist of labor, takes half the proceeds of the harvest, and takes it before the producer gets the first penny of it into his own fingers, back to those cheery days of old.

Cured ready for market, the nuts are stored or shipped just like barley, the same coarse gunny-sack being used. Its capacity is that of the cotton sacks used by Eastern farmers, by them branded and kept on the farm. The California sack is also often branded, but goes all the way to the final market and never comes back. All grain is shipped from Pacific ports in that manner. And, though the single sack costs but seven to ten cents, the whole expense is a great burden—estimated for the State at $2,000,000 a year—on the California producer. He can not escape it, for there are no elevators. Where grain has to be handled from five to ten times before reaching its consumer, the sack becomes a still more expensive crudity, shaving down the producer's

profits. To the grain-grower the average loss by it is officially estimated at ten per cent of his gross proceeds. The sacks alone cost me six per cent this year on the gross proceeds of a thousand bushels of the best brewing barley, sold at a price twenty-five per cent higher than that realized by the average grower of the common grades. How much I paid the warehouseman at home, the one in San Francisco, the one in Liverpool, and the brewer, each of whom handled it twice, for the extra work of the sack system over the elevator system, I do not know. They may have done it gratis, but I do not think so. At any rate, long after the system is universally recognized to be a monstrous and unnecessary burden, we shall be held to it by the same cause which binds England to its crude passenger-coach and America to its deadly hand-coupling and brake on its freight trains—the necessity of changing all at once and on so large a scale when the change is made.

But the burden on the almond-grower is trifling—one per cent for sacks in my case—the product being so much more valuable in proportion to bulk. The sack is altogether an advantage. It saves the delicate shell, and furnishes a place for the brand of the orchardist who is proud of his product and wishes to work up a reputation for it, and also for another brand giving the name of the variety contained in each sack.

An important practical question confronting every prospective orchardist is, How soon will my trees come into bearing and pay their own expenses and interest on my investment? In these days of harnessed steam and chained lightning, young America plants for himself and not for his children. Some old men who have tried it a little have come to the conclusion that too much planting for posterity is a mistaken kindness for which posterity, lying in the shade, kicking up its heels and letting its faculties rust for want of planting to do, returns no thanks. The almond is an early bearer. At four years from the seed the orchard of which I am the lessee yielded, at about average prices, about eighty dollars per acre gross—say sixty dollars net. This year at six years old, prices considerably below the average, the gross proceeds will be about one hundred and twenty-five dollars per acre. I do not think any other orchard yielded so much per tree, of the same size; but, on the other hand, these trees are so wide apart (twenty-eight feet) that there are only about half the usual number of trees on an acre. While the trees are small, this tells against the yield per acre, and so in this respect this orchard is probably only a fair example. It was not an exceptionally early bearer. In a general way it may be said that an almond orchard yields as quick returns as an average herd of beef steers, but not as quick as a herd of heifers. And in the mean time the planter

does not lose the use of his land. He plants other crops between the rows and does not lose a single year. But of course no ordinary annual crop can yield a profitable return on the price he will have to pay for land known to be adapted to almonds.

The almond, most precious by weight of all orchard products, involves the least labor, care, anxiety, expense, and skill of all, except perhaps the prune. In recent years it has never yielded the fabulous returns occasionally realized by the growers of almost every other fruit and nut. It never yields, as the orange has, a competence for life in a single year from ten acres. Its reasonable expectations are about one hundred dollars net per acre.

The old Latin form of the word almond (*Amygdala*) furnishes the name whereby botanists designate the genus to which belong its two species (*A. communis*, the sweet, and *A. amara*, the bitter almond), and the peach (*A. persica*).

LEATHER-MAKING.

By GEORGE A. RICH.

XV. DEVELOPMENT OF AMERICAN INDUSTRIES SINCE COLUMBUS.

ZADOCK PRATT, the great leather manufacturer, once gave as his toast at a notable trade dinner, "There is nothing like leather." The determined, enterprising spirit indicated by that sentiment may be said to be the distinguishing mark of the modern tanner, and it is possible that therein lies the explanation why one in tracing the course of that industry must look so largely to recent years for progress and development. But the course of this development furnishes an interesting commentary upon the application, or more accurately, perhaps, the lack of application, of the principles of science to this one of the industrial arts. Now, the art of tanning is one in which a knowledge of science, especially of chemical science, could be made to do most effective service. The operation is essentially a chemical one. Yet, as a matter of fact, since the first demonstration of the union of gelatin and tannin, chemistry has done almost nothing to facilitate the operation. It is not to that that the industry owes its remarkable progress; rather, it is to the invention of improved apparatus for hastening old processes. Just estimate, of course, must be made of the fact that the scientific knowledge of the principles involved in tanning did much to make these inventions possible. At the same time, however, as Mr. C. T. Davis has remarked in his admirable treatise upon leather: "Take

away our bark and hide mills, improved leaches and vats, handling and stuffing appliances, and other improved constructions; our splitting, scouring, boarding, whitening, polishing, pebbling, and other modern mechanical inventions, and our steam-power so economically derived from the use of spent tan as fuel; turn us out of doors to work among the rude contrivances of a century past, and would the result of our labor show an extraordinary gain either in time or quality over that of our predecessors?" Any review of this development, therefore, though it is a record of splendid achievements, is not one of the discovery or introduc-

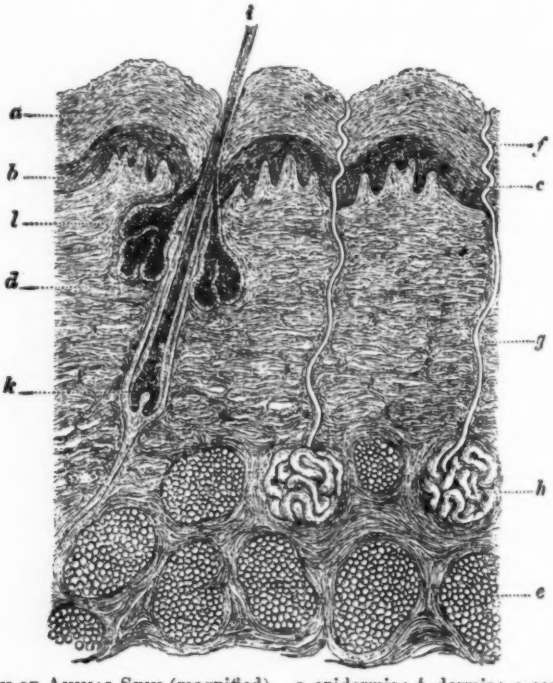

FIG. 1.—SECTION OF ANIMAL SKIN (magnified). *a*, epidermis; *b*, dermis; *c*, corium, or base of the skin; *d*, fibrous tissue; *e*, fat-cells; *f* and *g*, ducts of the sweat-gland; *h*, sweat-glands; *i*, hair; *k*, hair-bulb; *l*, sebaceous gland.

tion of new principles. It is a record of mechanical improvements and business economy.

Unfortunately, history gives us little definite information regarding the origin of this one of the industrial arts. Surmises, however, go for considerable in this case. The skins of birds and animals formed a large part of the first clothing of man. Now these would be found to grow hard and horny in their natural state, and on exposure to moisture to become putrid and offensive. Efforts to counteract this, and at the same time to render the skins soft and pliable for use, would be most natural, and to these are traced the beginning of the leather industry—an industry which

in its inception can properly bear no wider designation than the "dressing of skins."

Leather, in the broad application of the term, is a combination of gelatin and mineral salts, oil or tannic acid. The hide or skin of an animal consists of two layers—the outer (epidermis), a hard cellular plate into which neither nerves nor blood-vessels penetrate; and the inner, or true skin (dermis), a dense membrane composed of fibers interlacing in a curiously complex manner. These connecting fibers consist almost wholly of gelatigenous tissues. They will dissolve in boiling water, thus forming gelatin, will enter into solution with concentrated acids and alkalies, and will combine with oil and tannin. As such this tissue forms the basis of all leather, and the labor of the tanner becomes one of bringing it into chemical or mechanical combination with these other components.

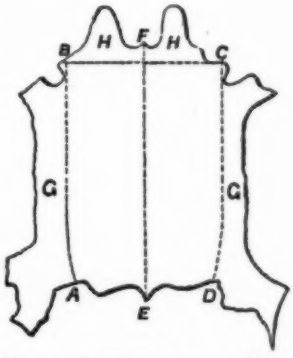

FIG. 2.—DIVISIONS OF A HIDE. A B C D is termed the "butt," and the halves of the butt marked by the dividing line E F are known as "bends." H H are the "cheeks," while the upper portion of the butt figures as the "shoulders."

The original process of curing skins was probably the simple one of cleaning and drying them. Removal of the hair by maceration in water seems to have been common among the very early tribes, and one writer has suggested that the idea was obtained from the natural process of depilation. They must certainly have been familiar with it in the case of drowned animals, where maceration can be plainly observed. Following this, smoke, sour milk, oil, and the brains of the animals themselves were found efficacious. Many of these primitive methods are employed at the present time, thus bringing into novel conjunction the days of the roving Massagetæ and those of the thrifty American. An acquaintance of the writer, a Massachusetts tanner, traveling recently through the province of Winnipeg, chanced upon a small Indian village. The place was in no way interesting except in the employment of the squaws. They were all busily engaged in removing the hair and muscles from the skins, largely those of deer and moose, which the bucks had taken in the chase. This they did by means of sharpened bones which they plied in a vigorous manner, rubbing away both flesh and hair. The skins, it seemed, had been taken from the animals some time before, and together with the brains partially dried in the sun. After the squaws had completed this scraping process, the skins were steeped in a lather-like mixture made from water and dried brains, and were then reduced to a soft texture by frequent knead

ing and similar manipulation. Ten days later this same manufacturer was in Peabody, Mass., in one of the most complete of modern tanneries, and, though the space of time intervening was only a little more than a week, yet in it he had traversed the whole gamut of the art.

In order of development after these crude methods came the discovery that certain astringent barks and vegetable substances possessed the property of condensing and arresting the septic tendency of animal membranes. This discovery must have been made very early, however, as the knowledge of it appears among many of the ancient nations. But, whatever the time, from it dates the beginning of the tannery. The Egyptians were probably among the first to become proficient in this process of preparing what had come to be such an important article of personal economy. Among the tapestries and sculptures that remain to us from them are several which picture the operations of currying, working, and stretching leather. One in viewing them might almost imagine himself in a small country tannery. Figures are seen using the familiar awl, polishing-stone, and the semicircular currier's knife, while the processes depicted are very suggestive of the present day. But the Egyptians are by no means to be given all the credit for this progress. They undoubtedly obtained many of their most valuable suggestions from the Arabs. Those roving Bedouins were by no means botanists in the modern sense of the word, but they had a thorough knowledge of all the peculiarities of such plants and shrubs as marked the desert, one of the most common of which was the acacia. That this knowledge was a practical one is proved by the fact that they were acquainted with the tanning properties of the pods of this plant. They were experts, too, in the methods of depilation, so that the Egyptians, by making a short excursion, had at

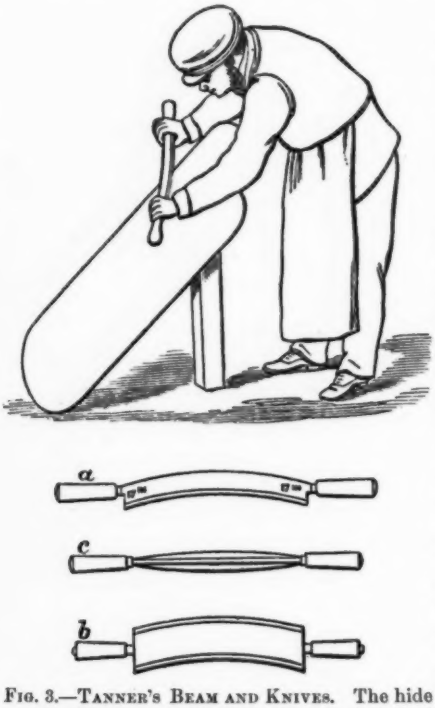

FIG. 3.—TANNER'S BEAM AND KNIVES. The hide was thrown over this beam after the hair had been loosened, and with the working-knives (*a* and *c*) and the fleshing-knife (*b*) was scraped free of both hair and refuse. Machinery has very largely superseded these now.

FIG. 4.—OLD PUTNAM TANNERY IN SALEM MASS.

hand a considerable foundation upon which to begin the development of their art. But, once known, its extension could not be hindered. Herodotus states that the Libyans wore leather clothing, and that the Phœnicians, whose home was a barren stretch of shore, depended largely upon it in the construction of their

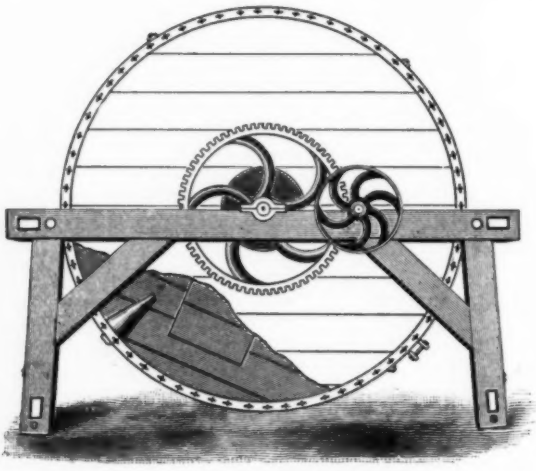

FIG. 5.—DASH-WHEEL.

ships. Persian and Babylonian leather was long celebrated, and as early as the beginning of the Christian era the Russians were famous as skilled tanners. Hungary, too, acquired an early name for its leather, having learned a peculiar process for making it from Senegal. Boucher carried the art into France; while Colbert, the enthusiastic patron of all the industries, did all that he could in the way of personal and public effort to extend it. Thus it was that leather became more and more an article of general use, and thus it was that by the time Columbus started on his hazardous voyages there had already grown up a considerable industry in England, France, Spain, Germany, and Russia.

But despite all this growth the processes involved in the operation of tanning were not really understood until the close of the eighteenth century, when they became objects of scientific study. Before that time the art was purely an empirical one. The immediate successors of Columbus brought with them to America such crude knowledge of it as was current at the time. Leather being a prime necessity, tanneries were started soon after the settlement of each community, either by the men of that craft or by the large farmers for their own convenience. Leather formed at that time no small part of people's clothing; indeed, leather breeches appeared clear into the eighteenth century, though the wearing of them was largely confined to servants and laborers.

It figured in nearly all the arts. It was used for harnesses and saddles. It was fashioned into boxes and articles of ornament. It served both as a protection and defense. Nevertheless, but little progress could be made until the settlers had obtained a stock of domestic cattle. Columbus is said to have brought the first of these animals to America on his second voyage thither in 1493. By 1610 they had been introduced into Virginia, while Plymouth and the New Netherlands received a supply a few years later. Tanneries then were started North and South. In a list of tradesmen to be sent to Virginia in 1620 are enumerated tanners, leather-workers, and shoe-workers. In 1649 Captain Matthews, an active

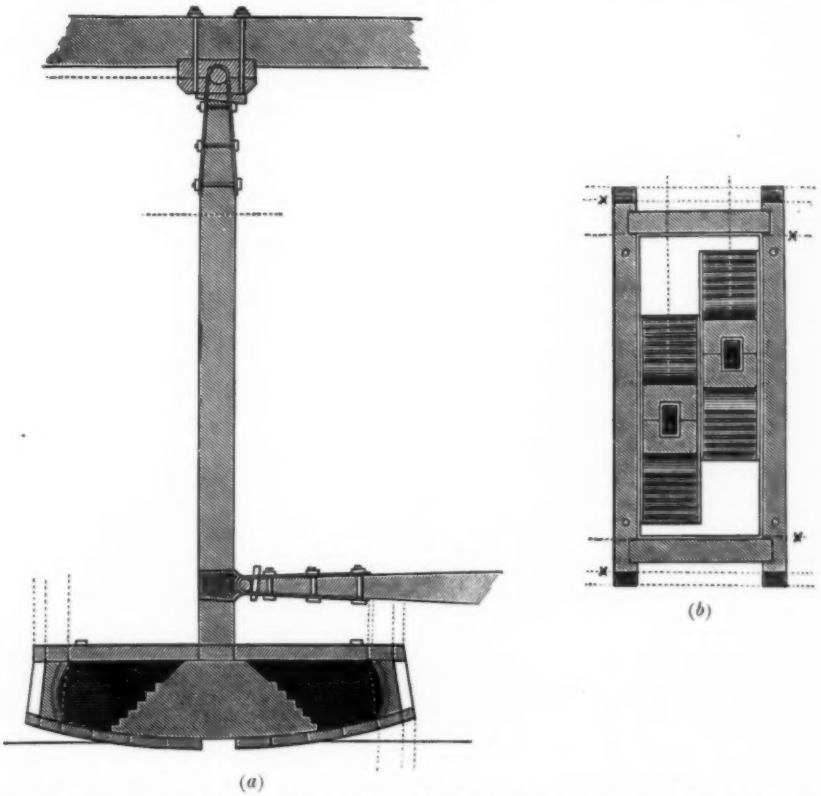

FIG. 6.—HIDE-MILL. The above figures (*a* and *b*) represent a working plan of the "Shover" hide-mill, or ordinary "fulling" stocks for softening hides. It is essentially the same as the apparatus used for fulling cloth, and is undoubtedly the forerunner of the modern washing machine.

figure in Virginian history, received legislative commendation for his enterprise in the building of a tan-house, the manufacture of leather, and the employment of eight shoe-workers. The Virginia Assembly, however, a dozen years afterward had to come to the rescue of the industry, passing a law which required that tan-

houses should be built in every county at the county charge, and that provision should be made for the employment of tanners and curriers. The rates of hides and shoes were fixed, and stringent efforts were made to prevent the exportation of hides. Maryland adopted similar measures; but Beverly, writing a few years later, says of these enterprises that "a few hides were with much ado tanned and made into servants' shoes, but at so careless a rate that planters don't care to try them if they can get others."

Fortunately, the industry fared better in its first planting in New England, and Higginson probably struck the secret of this good fortune when, in 1630, he called attention to the extraordinary increase of cattle in Massachusetts, and the "store of sumacke trees, good for dyeing and tanning leather." Cattle continued to multiply rapidly from 1630 to 1650, but the prices placed upon them were so high that few were slaughtered. But in the latter year the cessation of immigration from Europe caused a depression in the cattle market, and they began to be killed freely, thus supplying the tanners with the necessary hides. The Massachusetts General Court, in 1640, recognized the importance of the industry, and passed a law punishing those who slaughtered cattle and neglected to save the hides and have them tanned. But Connecticut, Massachusetts, and Rhode Island thought that they must take a stronger hand in the pushing of this industry—those were in truth the days of infant industries, and of detailed trade regulations—and so special laws were passed for that purpose. Protection, in the current political sense of the word, was not known then, but the same ends were attained through the guild privileges. The general law of Massachusetts, passed in 1642, is typical of these regulations. This declared that no leather overlimed or insufficiently tanned, or not thoroughly dried after tanning, should be exposed for sale. Tanners putting leather into hot or warm "moors," where the leather should heat and burn, were to forfeit twenty pounds for each offense. Curriers were not to dress any leather imperfectly tanned or dried, nor use "any deceitful or subtle mixture, thing, way or means to corrupt or hurt the leather, nor curry any sole leather with anything but with good, hard tallow, nor with less than the leather would receive; nor dress or curry any upper leather but with good and sufficient stuff, not salt, and should thoroughly liquor it until it would receive no more; they were not to burn or scald any leather in the currying, on forfeiture for every one marred by unworkmanlike handling, to be judged by the oath of sufficient witnesses."

This law, probably, was of little value to the industry, as some years later it was repealed, and all efforts to enact similar measures proved fruitless. It throws an interesting light, however, upon some of the methods and practices then in vogue, as it was

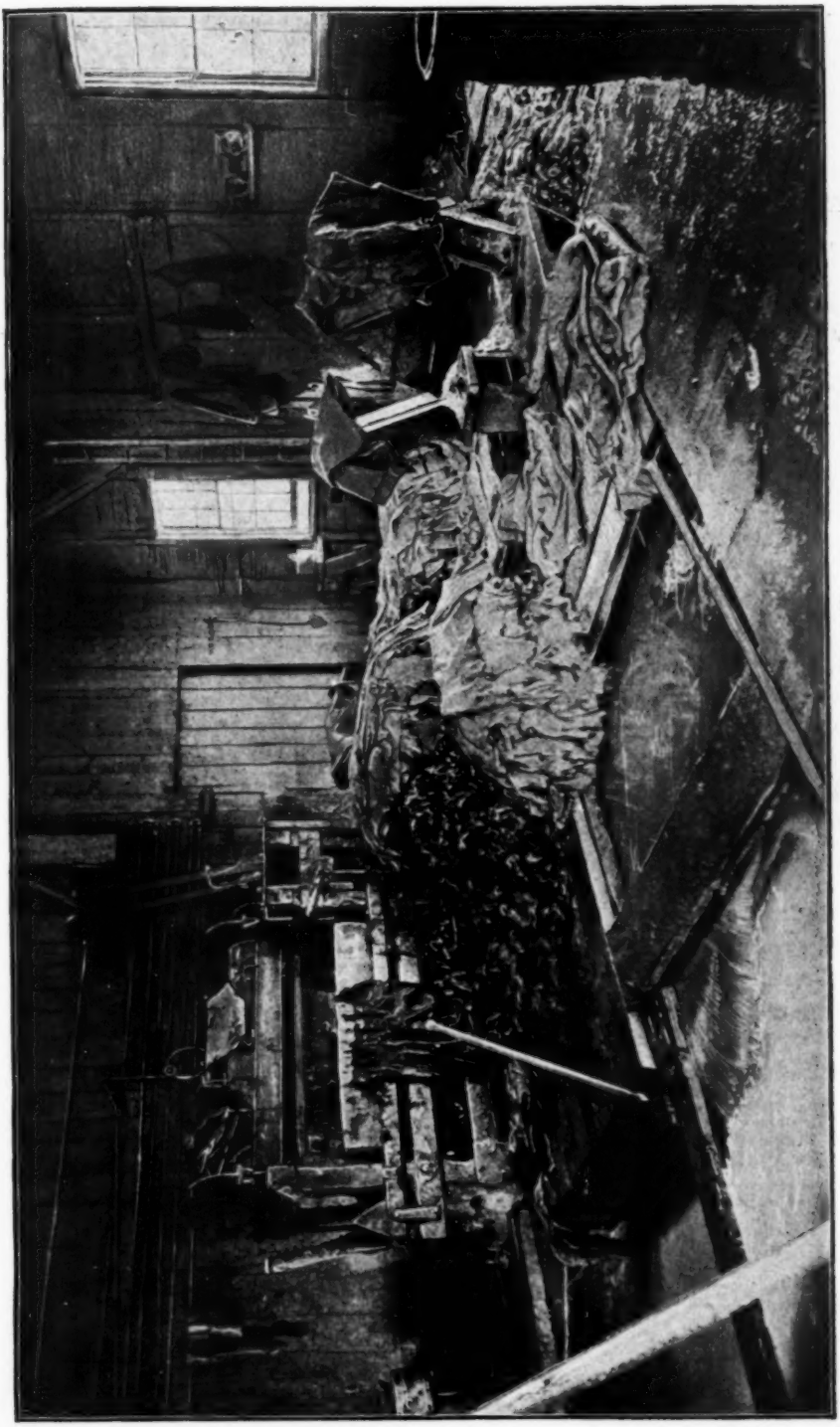

FIG. 7.—CORNER IN A BEAM HOUSE.

stated that these laws were passed in consideration "of the damage or injury which many sustained by the ill-curing of leather, and by the shoemakers in making it up into shoes and boots." Thus left to shift for itself, the industry steadily though slowly progressed with the country until 1860, when new inventions and improvements in processes, and energetic men at the head of it, gave it a decided impetus which has constantly gained in force since.

As has been said, the fundamental processes of tanning have changed very little since the early days. The hides, as they came

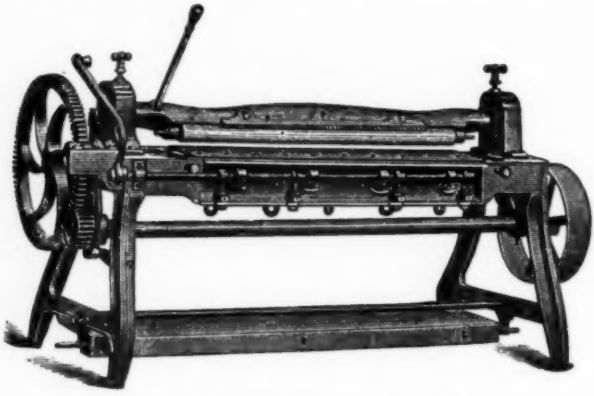

FIG. 8.—UNION SPLITTING MACHINE.

to the tanner, were first washed, and then, in order to remove the hair, soaked in vats of water and lime or ashes. After having been thus unhaired, they were put over a beam and scraped until every remnant of flesh had been removed. After another washing they were "laid away"—that is, packed in vats in alternate layers of ground hemlock or oak bark. The object of this was to bring about the desired union of the gelatin and tannin. The operation, however, was a slow one, and oftentimes many months were required to complete it. But study, of course, has been since given to the details of these various steps, which has resulted in a marked saving of time. In the preliminary process of depilation there are two methods which are now commonly followed by American tanners. The first is known as the "liming," which is used largely in the preparation of upper leather; and the second, known as "sweating," which is used for sole leather. In the "liming" process the hides are soaked in a solution of lime and water, as indicated above, until the hair-bulbs are loosened. In sweating there are two methods also: the warm sweat, with the temperature of the pit at 100°; and the cold sweat, with it at 50° or 60°. The former method is in general use in southern Europe, while the latter is not only American in origin, but is the

favorite one with tanners on this side of the water. Again, the process of depilation is still further hastened by the use of a mineral acid, like sulphuric, or by the handling of the hides in the old sour liquors where the tannic acid has become largely converted into gallic acid. There are strong advocates of both cold sweating and warm sweating, and of acid and non-acid methods, but there are no data on which pre-eminence can be assigned to any one of them. All have played an important part in abbreviating the tanner's work. Following depilation the hides are colored or passed through a series of vats containing liquors of varying strengths, and then laid away. Here, also, it is a matter of opinion as to what is the proper time that should be given to each of these operations. The late Hon. Gideon Lee, in a course of lectures on the art of tanning, declared that he found quick-tanned leather of firmer and closer texture, and at the same time heavier and more durable. By keeping the hides too long in the liquors or vats the gelatin was disolved. But, whatever the general census of opinion, these processes have reduced the time required in the tanning of a hide from twelve and eighteen months to four and six months. Visions of a still greater abbreviation have been common, and "quick tanning processes" appear about so often. Some of these are historical. They include attempts to force the tannin into the hide by

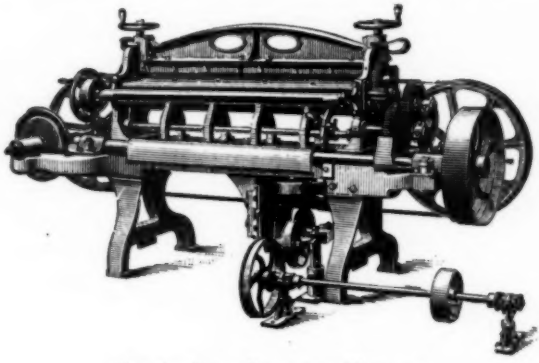

Fig. 9.—Belt Splitting Machine.

hydrostatic pressure, and by the pressure of the air under an exhausted receiver. They include the application of the principles of osmose and kyanizing. The latter experiment was made by a young English engineer, who in his early life had been engaged in preserving wood by kyanizing with chemical agents. He came to this country and spent ten thousand dollars in constructing a large iron, egg-shaped, copper-lined tank. This was capable of holding one hundred butts, and of resisting an immense pressure. He provided pumps so that he could exhaust the air of this tank,

converting it into an almost perfect vacuum, and at the same time force liquor into it, producing a pressure of one hundred pounds to the square inch. Between the hides he placed cocoa matting, so that the free circulation of the liquor should be in no way interfered with. In the top of the tank, where it was impossible to put hides, some small blocks of wood were placed. He afterward exhausted the air in his tank, forced in the liquor, and then waited several days, but his experiment was a complete failure. On examining the contents of the tank, he found the wood thoroughly saturated with tannin, but the hides were scarcely colored. The pressure that would kyanize wood would not tan leather. Recently attempts have been made to employ

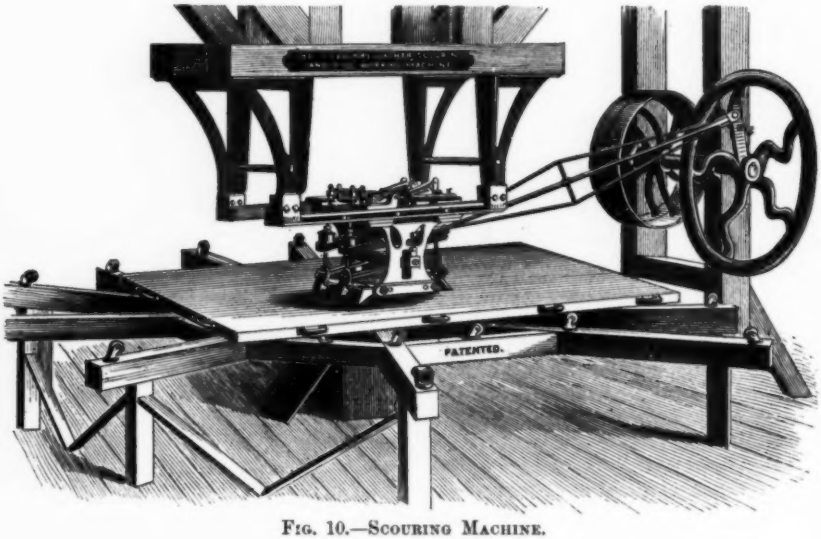

FIG. 10.—SCOURING MACHINE.

electricity to hasten the operation, but as yet no practical and satisfactory "quick tanning" process has been found.

Few, if any, of the pioneer tanneries remain. That, however, which used to belong to Mathias Ogden and Colonel Oliver Spencer, at Elizabethtown, N. J., in 1784, was probably a good example of the original type. That consisted only of forty or fifty oblong boxes, without cover or outlet below, sunk into a bed of clay near a small stream. The boxes did duty as vats and leaches. On one side of them stood an open shed which fronted a half-dozen more boxes, the "limes" and "pools" of the beam-house, while on the other side was a circular trough, made of hewed timber, fifteen feet in diameter, in which the bark was crushed by alternate wooden and stone wheels propelled by two old horses. It was essentially a home-made plant. The wind swept through it without hindrance, and the rain and snow beat un-

challenged upon it, hastening the decay of the vats and boxes, and giving an air of desolation to the tannery. But despite all this crudeness, as Bolles has said, and investigation tends to confirm, in this way throughout New England and the Middle States, leather, probably equal to that of any European country except England, was made even before the separation, to an extent more nearly approaching a sufficiency than any other article.

As already noted, the tanner owes more to the mechanic and machinist than to the chemist. In 1793 Deyeux, a French chemist, discovered that tannin was a peculiar body, and two years later Seguin proved that it was the active principle demanded in the operation of tanning. This led to something of a study of the properties of tannin and its distribution. In 1801 Banks, an English chemist, found that it was contained in *terra japonica* or catechu, and since then the list from which it can be extracted, and profitably, too, has been greatly enlarged. The use of liquor containing this active principle of hemlock or oak bark, the "ooze," as it is called, was suggested in England in 1759, but it was first rendered practically successful by Fay in 1790, and Seguin, of France, in 1795. The English had rendered their leather flexible by giving it a thorough beating with hammers by hand. Switzerland, as early as 1800, used water-power hammers, and subsequently replaced them with stamps. Berendorf, of Paris, in 1842, invented a pressing stamp, afterward supplemented by Harvey and Devergue with a roller which accomplished the same thing by passing it back and forth over the leather.

These advances in Europe were not duplicated in the industry in this country. They had their counterparts here, however, and in the end the progress of the Americans, which is measured in this case by the shortening of the operations and the cheapening of the product, kept pace with their craftsmen across the water. Accidents are said to play an important part in the development of any industry. Analyses of these incidents, however, usually show that the accident lay simply in the fact that there happened to be an observing man, of suggestive mind and quick application, about when the occurrence took place. Barrels full of apples probably had fallen before the historic one caught the eye of a Newton. The steam of the tea-kettle might be making music today without any further results had not fertile-minded Watts, or his double, heard it and seen it. In the same way these forward steps in the making of leather came from a combination of ordinary incidents and practical men who saw in them suggestions for better things. One of the pioneers in bringing about these changes in this country was Colonel William Edwards. He built a tannery at Northampton, Mass., about 1790, selecting the

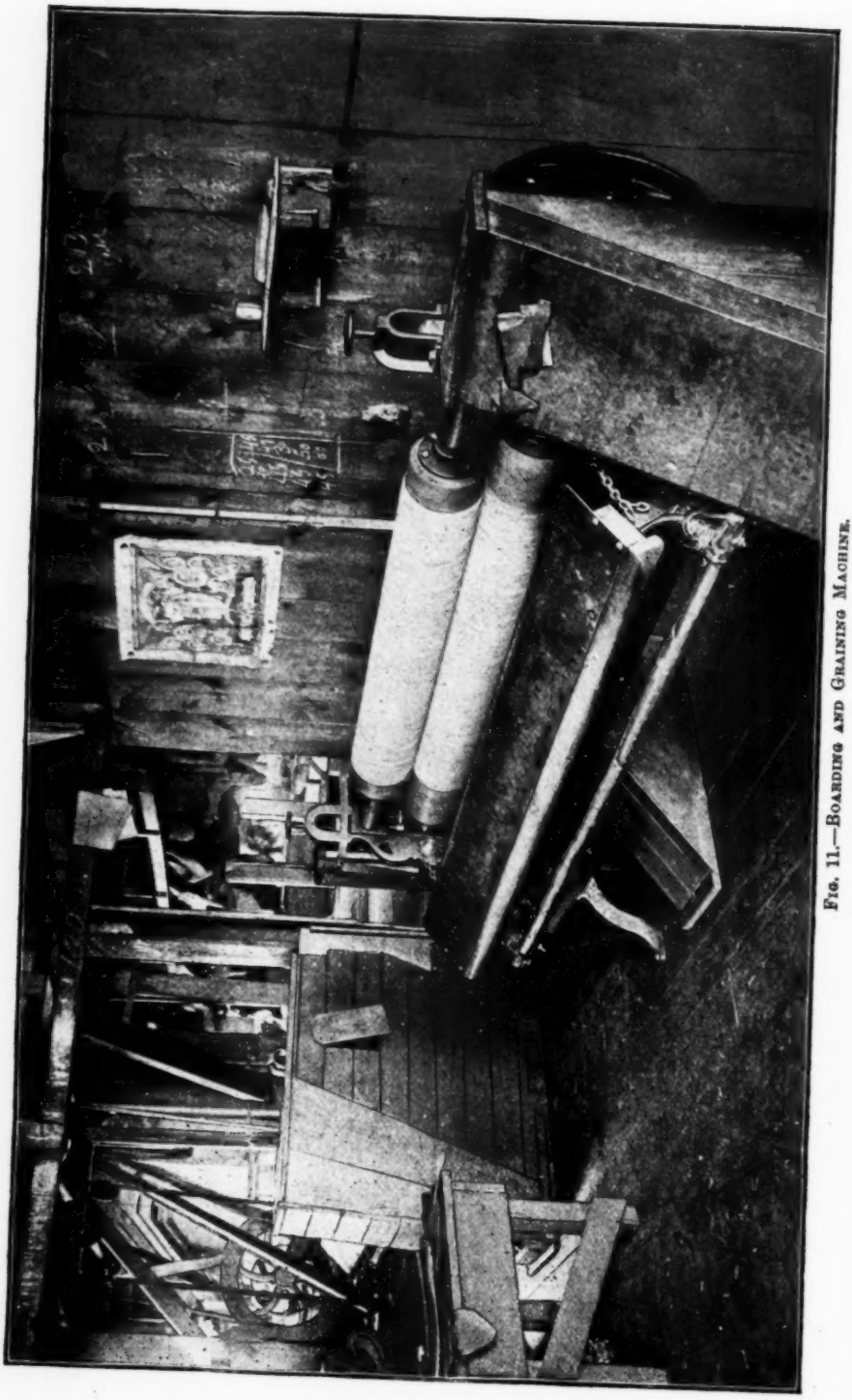

FIG. 11.—BOARDING AND GRAINING MACHINE.

clayey side of a hill for its location. There was a fine spring of water just above his vats, and the natural flow of it was enough to keep them filled. Colonel Edwards's first improvement on the tannery of the day was the making of a place beneath the vats for carrying away the spent liquor. The Ogden and Spencer tannery, it will be remembered, had no provision for getting rid of

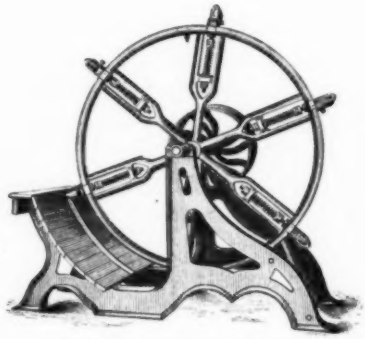

FIG. 12.—POLISHING MACHINE.

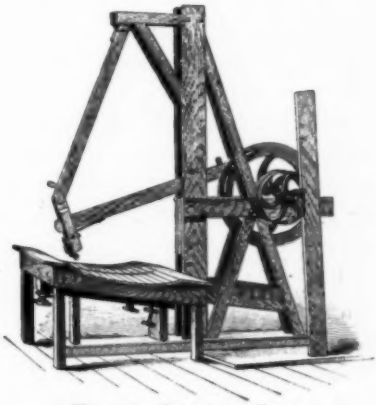

FIG. 14.—PEBBLING JACK.

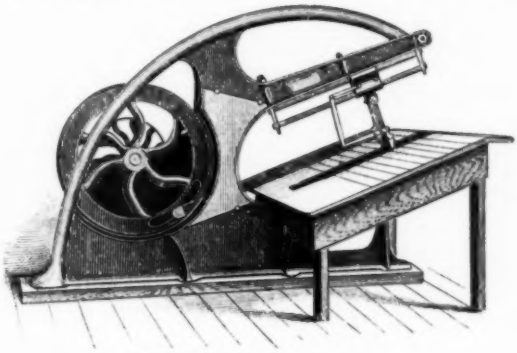

FIG. 13.—GLOSSING JACK.

FIGS. 11, 12, 13, and 14.—A great variety of machinery has been introduced for finishing the leather after it has been tanned. Most prominent among them are those figured above. The object of the boarding machine is to bring up the grain and give a granular appearance to the leather. The other machines are for the details of the process.

that refuse. Colonel Edwards, too, arranged his leaches in tiers, one above the other, and used a suction-pump for raising the liquor. He built a mill for grinding his bark, and, instead of the customary horse as motor power, used water. Perceiving that his leather tanned faster in summer, the application of heat was suggested, and the result was the invention of the copper heater. Dry hides had become very plentiful at that time, and Colonel Edwards had used a stone wheel to soften them. This, however, was a slow operation, and as an experiment the colonel took a

few of the hides one day to a fulling mill that was near. The result of that venture was the hide mill. The work of Colonel Edwards was amplified and supplemented by others, until the leather industry had become one of the most firmly established in the country. Of these changes Mr. Pratt, to whom reference has been made, said in 1859:

"From 1815 to 1835 tanneries, which had previously been hostless though not homeless, were provided with roofs and shelter. From 1830 to 1836 we adopted several improvements in manufacturing, among which was a change in the method of unhairing the hides. Discontinuing the use of lime, we adopted, for sole leather, the process of sweating, a method which was falsely patented in this country, having been known in Pennsylvania, Maryland, and Germany. Another improvement was the substitution of fulling or softening in the hide mill in place of the old process of soaking and breaking over the beam. We also discontinued the wasteful operation of skiving, and by these improvements we succeeded in producing at less expense a larger quantity and a better quality of leather. The old method of thrashing the bark was replaced by the rotary grinding stone, and this plan in turn was replaced by the bark mill, invented by Tobey and others, worked at first by horse-power and afterward by steam and water power. As the principles of tanning became better understood, the bark was ground fine, instead of coarse, as before. The old lever pump made way for the press and screw pump; the old slicker of wood, stone, or glass gave place to the rollers made of brass. The water, also, was no longer applied cold to the bark, but heat was added to the leaches, by heaters, pan and steam, and thus the tannin was more effectually extracted. Larger leaches came into use, and the leather was put through a series of baths containing ooze of different strengths. Manual labor gave place to the more economical force of steam and water power. The change from the tanneries of the past to those of the present may be described as a change from chaos to system, from waste, confusion, and long delay, to method, economy, order, and dispatch."

These changes are represented in the hide mill, the bark mill, the splitting machine, the stuffing-wheel, the scouring machine, and the boarding machine. The hide mill was the invention, or rather adaptation, of Colonel Edwards, of Northampton, to whom reference has already been made, and the patent granted him by the Government bears the date of December 30, 1812. The next patent on this mill was not taken out until 1867, the patentee being Mr. J. M. Brown, of Boston, thus showing how comparatively few and slow were the changes in it. The object of these mills is to soften the tough, dry hides so as to render them not only easier of manipulation but readier to absorb the tannin. The mills, as

used at the present time, vary in construction according to the grades of leather desired. Some of them are simply great drums, the interiors of which have been stuck over with rows of oak pins. In this way, when these drums are put in motion, the hides, one hundred and fifty to two hundred in number, fall upon the pins and are thoroughly beaten and their fibers loosened. The more common form of the mill, however, consists of a reservoir into which are projected a number of arms or beaters connected by rods to a shaft outside, and this latter as it revolves imparts a reciprocatory vibrating motion to the beaters. But how little advance even this is upon the ancient Egyptian fuller is apparent to

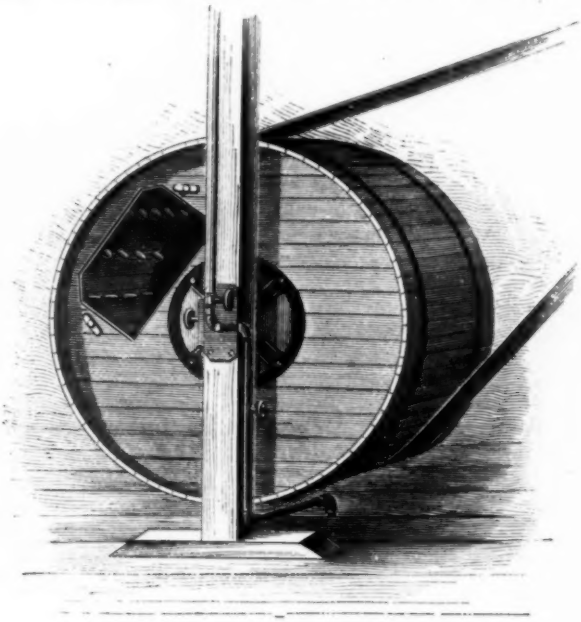

FIG. 15.—STUFFING-WHEEL.

one who will take the trouble to look over some of the old prints. These show the rolls of cloth wetted and manipulated between a block and concave inclined table, with the water passing into a trough at the bottom. These all have their counterparts in the modern fulling or the modern hide mill. The hide mill was introduced among American tanners about 1830, at Salem, but it did not really come into general use, especially among the hemlock tanners of New York, until 1850. Perhaps the invention best entitled to the term "epoch-making" is that of the splitting machine. Indeed, it was the pioneer of the great improvements in the industry, and the effect of it was no other than to revolutionize the currying and finishing business in this country. Previous to its invention the tanned hides had been shaved down to

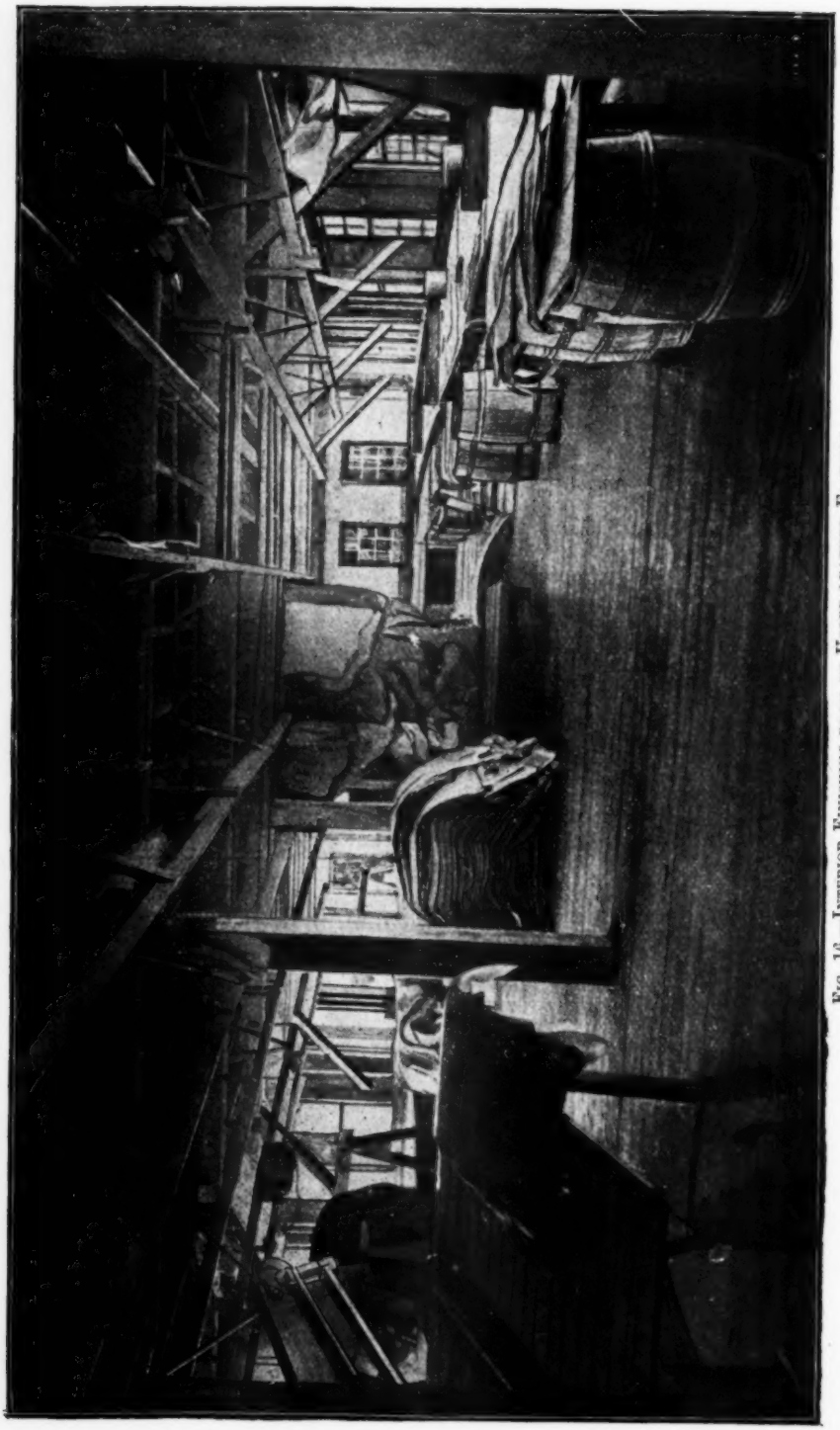

FIG. 16.—INTERIOR FINISHING-ROOM IN UPPER-LEATHER FACTORY.

the desired thickness by hand, entailing obviously a great waste not only in time but in the large portions of the hide which it was necessary to throw away. By the use of these machines, however, these same hides may be split into two, three, or even five parts, of such thickness as is desired, and each part rendered available. This machine was not really perfected until about 1860. As early as 1800 rough attempts had been made to split leather by machinery, and in 1809 Seth Boyden, of Newark, N. J., secured a patent for such an invention. But there were serious obstacles which

Fig. 17.—Bark Mill.

rendered it impracticable, and it was left to the ingenious mind and skilled hand of Alpha Richardson, of Boston, to overcome them. He secured his first patent in 1831, but he continued to make improvements upon this device until 1856. Then all were grouped, and what is known as the Union splitting machine was the result. This machine is the one which is now in common use among American tanners. Its machinery is somewhat complex. It consists of a small cylinder upon which is placed the hide or leather to be split. As this cylinder turns, the leather is drawn against a sharp knife firmly bolted to the bed of the machine. Above the knife is a stiff spring which holds the leather closely to the edge of the blade, and a gauge-roller, which by means of

screws regulates the thickness of the side, and by sectional tubes or rings serves as a friction-roller. When it is desired to split whole hides, a still more complicated machine is employed. This is known as the belt-knife splitting machine, and was invented in 1854 by Joseph F. Flanders and Jere. A. Marden, of Newburyport, Mass. The knife in this machine consists of an endless band of steel, which revolves at a high speed, with its cutting edges close to the sides of a pair of rollers. Through these latter the leather is fed and pressed closely against the knife. The lower roller is made up of a series of rings which are capable of yielding so as to accommodate themselves to the varying thickness of the hides. The thickness of the splits is determined by a small hand-screw, by which the upper roller is raised or depressed as the case may require. The knife itself in its course of revolution comes in contact with an emery-wheel and thus is kept keen. These machines present a blade varying between fifty-seven and seventy-two inches in length, and by them an ordinary cow-hide can be split into three or four distinct parts with the utmost precision.

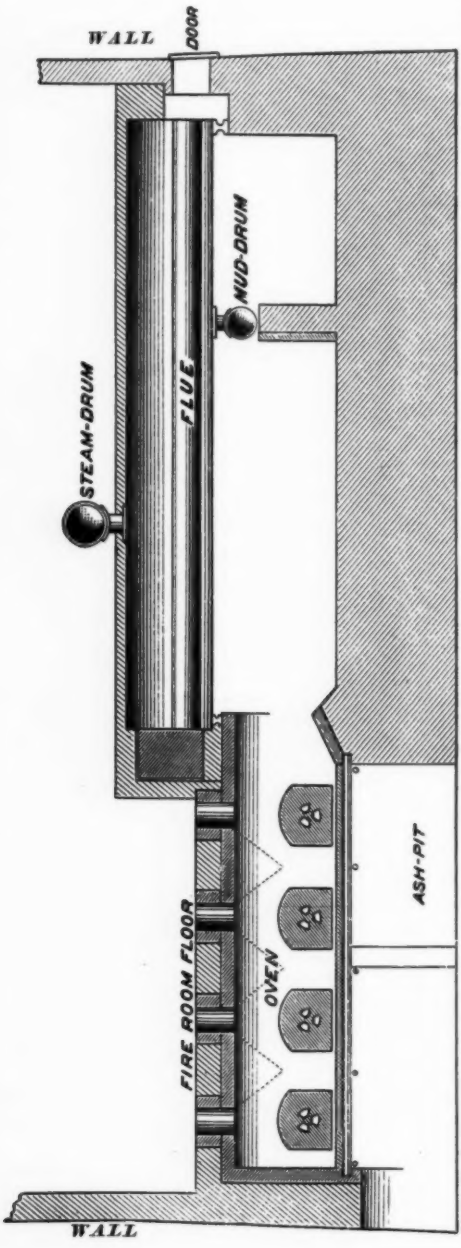

FIG. 18.—HOYT SPENT TAN FURNACE. The above illustration is from the Hoyt furnace at Wilcox, Pa., which consists of two pairs of ovens connected with three horizontal flue boilers. The portion in the cut consists of a section through one of the ovens and one of the boilers, showing the oven, ash-pit, grate, holes for feeding the tan into the oven, the boilers, and the door to sweep out the flues.

It would be impossible to even enumerate the many inventions that have been made to save hand labor and hasten the various processes of finishing. Among the most serviceable is the scouring machine. When the leather is taken from the vats it is usually covered with dust and sediment and stained with resinous matter. Formerly these defects were removed by hand with brush, stone, and slicker; now, however, it is done by "scrubbers" and scouring machines. There is a variety of these, but in general they consist of a level table or platform which is freely movable in all directions. Mounted above it is a reciprocating frame, in which are fixed brushes and pieces of slate and thin stone. By the movement of this, with a small jet of water, the whole surface of the leather is scoured and brushed. Another invention—this to replace the work of the currier in paring and evening and bringing out the grain of the leather—is the whitener. Essentially this machine is like a lawn-mower. It performs its work through the cutting action of a small cylinder with sharp, oblique edges. The cylinder itself moves to and fro over the leather while the knives revolve at the rate of two thousand times per minute. In the machine invented by Mr. Charles Korn, one of the most skillful leather-finishers in the country, these knives are fastened to an endless leather belt, and are set diagonally, so that when the cut is made on the beam as it passes down in front of the operator it is a sliding one. The knives are cleared on the edge by an automatic finger and sharpened by an automatic hand. In the Union leather whitener the belt contains thirty-two knives, while the cylinder revolves 2,780 times per minute, and the pendulum swings to and from the operator at a speed of ninety a minute. These machines can do the work of from four to eight men, and do it as well. Still another finishing machine is the stuffing-wheel, by which the tallow and oil are worked into the leather. This was patented in this country in 1855 by L. W. Fiske, of Louisville, Ky., though it had been previously used in France and Germany. The crude idea of a stuffing-wheel is a revolving hogshead into which the leather and grease are put and a current of steam or heated air passed through. The success of this wheel did much to revolutionize the character of the upper leather of this country. By it the oil and tallow were worked into the center of the fiber, thus making the leather soft and yielding instead of stiff and hard as of old. These devices nearly all had their origin about the time of the civil war, when workmen were scarce in the North, and when manufacturers had to turn their attention to some means of supplying the deficiency.

In point of importance, next to the invention of the splitting machine, stands the discovery of a method for utilizing spent wet

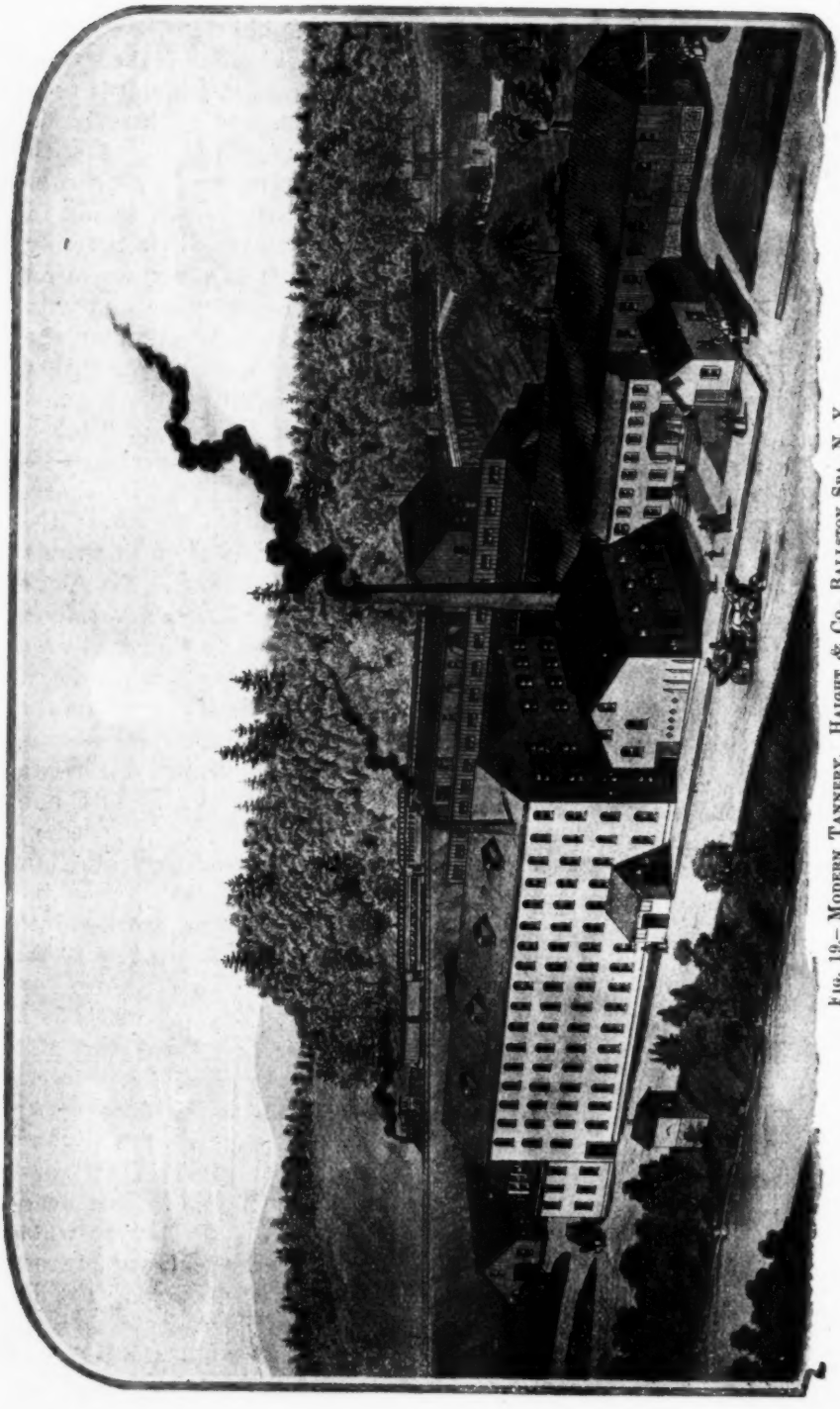

FIG. 19.—MODERN TANNERY. HAIGHT & CO., BALLSTON SPA, N. Y.

tan. Both were economical devices. The New England tanners had long been accustomed to dry their spent tan during the summer and store it for winter use. It was then brought into service to heat liquors, and in some cases to generate steam for general tanning purposes. It was found, however, that nearly a half of it was lost in drying. The result was, that attention began to be given to the problem of utilizing it to greater advantage. In 1852 Joseph B. Hoyt conceived the idea that the wet spent tan might be burned in a detached brick furnace. He made the experiment at his tannery in Woodstock, Ulster County, N. Y. After several trials he was successful, and got from the utilization of this hitherto useless product enough power to drive his whole machinery. Since the success of Mr. Hoyt a number of furnaces have been devised for burning this wet tan. That of Mr. Hoyt, as perfected by him, consisted of two pairs of ovens, each pair being connected with three horizontal flue boilers. Each oven, with its boiler, was independent of the other, and each had a separate feed-pipe, steam-pipe, and water-tank. The only things in common between the ovens were the fire-room and the chimney. The ash-pits were the entire width of the grate, and the distance from the under side of the grate-bars to the bottom of the ash-pit was nearly five feet. This permitted a double current of air to form in the ash-pit, the cold one entering at the front near the bottom, passing toward the back end, becoming gradually warmed by the intense heat from the grate, a part entering the oven through the grate, and the rest finally passing out of the ash-pit at the front at a temperature of 300°. By closing the furnace so as to prevent the return current, the temperature of the ash-pit could be raised to 500°. The success of these furnaces worked an immediate change in the whole tannery economy. Hitherto tanneries had been limited to the banks of streams, where they could get good water-power. Now such power was not necessary. Tanneries could be located in the open flats, where access was easy, and where the inconveniences and expenses of elevations could be avoided. Fuel was no longer an item of importance. Tanners, therefore, were not obliged to confine themselves to one great building, but they could spread out into as many smaller ones as their convenience and business demanded. They, furthermore, were no longer obliged to consider the cost of generating steam, and as a result labor-saving machinery commended itself to all. The discovery of this method of burning wet spent tan has been the determining element in the construction of the modern tannery. At the same time it has been one of the most important factors in reducing the cost of the production of leather.

From the definition of leather already given—a chemical or

mechanical combination of gelatin and tannin or mineral salts or oil—it is evident that tanned leather is not the only kind of leather. Indeed, there may be said to be three kinds, depending on the constituent elements. There are (1) tanned leather, in which the gelatin is combined with tannin or tannic acid; (2) tawed leather, in which the gelatin is combined with mineral salts; and (3) shamoyed leather, in which the gelatin is combined with oils and fatty substances. Sir Humphry Davy has distinguished between the first of these and the second and third by the statement that tanned leather is a chemical combination, its characteristic being that water will not separate its constituent elements or dissolve their connection, whereas in the case of the others it will return them to their original components. All three kinds of leather are made largely in this country. Tawed and shamoyed leather are used extensively for gloves, clothing, and domestic purposes. Some of the finer qualities have a wide use for fancy finish and ornamentation; but red tanned leather is the oldest in this country, and overtops the others by far in extent and importance, and the processes described have been those pertaining to its manufacture. And there is a wide variety in that. The heavier grades of leather, such as are used for trunks and the soles of boots and shoes, are made from the butts or the back of the hides of the buffalo, ox, and cow. The lighter grades, such as kip or upper leather, are made from the hides of young cattle older than calves and from the hides of a small breed of cattle common to India, Russia, and Africa; while all the spongy leather and morocco, or its imitation, is prepared from sheep and goat skins. These distinctions, however, are only genèral, but they indicate the lines along which the various branches of the industry divide. American tanners, too, have not been slow about introducing new varieties of leather. Japanned leather, used largely for fancy work and for certain styles of shoes, was first made in this country in 1818 by Seth Boyden, of Newark, N. J. In the manufacture of this the leather is first coated with a compound of linseed oil, umber, and lampblack, applied three or four times, and then is treated to a varnish made of Prussian blue and linseed oil. The leather, which had previously been stretched over frames, is afterward run into ovens heated up to 175° Fahr. Newark, too, was the original home of the enameled leather industry, David Crockett having introduced that finish. This is made much like the japanned leather, except that it is less smooth and less highly polished, the aim being to bring the grain into relief. This is used almost wholly in the coverings of carriages, and it is a branch in which America has always held the lead. Alligator skins were first tanned in Louisiana about 1855, and a considerable business has since grown up in some of the States.

The leather, however, is to be regarded rather as a novelty than as a permanent addition to the industry. American tanners, too, have been quick to learn the methods of making the best of the foreign varieties of leather, and in some cases they have even improved on the original processes. Among these leathers of foreign origin are russia, a strong and pliant variety, generally of a red or black color, and with a peculiarly penetrating odor due to the oil of birch; and Cordovan, a small-grained, soft leather, which takes its name from the Spanish city of Cordova. It was from the gradual modification and improvement of this last that the so-termed morocco leather has resulted. This, with its brilliant colors and beautiful finish, has come to be very widely used. The manufacture of it is carried on in nearly all places where the leather industry flourishes at all, but the centers of the business are at Philadelphia, Pa., Newark, N. J., Wilmington, Del., and Lynn, Mass.

The distribution of the tanneries in this country, and as a result the centers of the leather trade, has been largely determined by the distribution of tanning materials. Tannin, the active vegetable principle of tanning, has been found in a wide variety of plants and trees. As a matter of fact, however, the only substances used largely here are the bark of the oak, the hemlock, and the sumach. Hemlock bark is found generally north of central Pennsylvania, throughout northern New York, north of Lake Michigan, and through Maine and Canada. Oak bark, on the other hand, is found abundantly in the vicinity of the Cumberland and Alleghany Mountains, and the lesser ranges of the Blue Ridge, while the sumach flourishes in Virginia and Maryland. Southern sumach, however, is not so highly esteemed as that obtained from Sicily, and much of this is imported. Some other varieties of tanning materials also are imported, like terra japonica, but the staff of the tanner in this country is the oak and hemlock. It is in those sections of the country that the tanneries are found. New York is the largest general leather market in the United States, while Boston stands close to it, especially in upper leather. Philadelphia, Cincinnati, Chicago, and Baltimore, too, are leading trade centers. The growth of the industry has been very marked since 1860. In 1850 the total product of leather in the United States was valued at $32,861,796, and the capital invested was estimated at $18,900,557. New York State stood at the head of the list, with an output valued at $9,804,000; while Pennsylvania came next, with $5,275,492; and Massachusetts third, with $3,519,123. In 1880 the value of the output had increased to $113,348,336, and the capital invested to $50,222,034. There were then 3,105 tanneries in the country. The position of the six leading States is well represented by this table:

State.	Establishments.	Capital.	Hides.	Skins.	Total value of products.
Pennsylvania	642	$15,608,635	2,970,680	635,280	$27,042,068
New York	386	11,710,415	2,503,855	4,171,290	23,652,366
Massachusetts	133	2,712,130	1,625,344	3,724,897	13,536,721
Maine	83	2,439,700	879,160	2,202,158	7,100,967
Illinois	34	2,220,114	395,030	1,486,570	5,402,070
Ohio	302	2,022,990	436,015	434,732	4,357,273

There were, besides this, 2,319 currying establishments in this country, with a product valued at more than $71,000,000. The census figures for 1890 will undoubtedly show even larger increases in production. This increase is reflected in the importation of hides, which for the year 1891 aggregated $27,930,759. During the decade important tanneries have been started in some of the Southern States, and the industry is constantly expanding. This fact appears in the extension of the American leather trade abroad, but this is by no means what it should be. The exports of leather in 1891 aggregated $12,026,556, a gain of a little more than a million dollars as compared with the previous year. Sole leather led, with a sale of 40,084,833 pounds abroad, at a total sum of $6,430,764. It is interesting further to compare the exports of leather and the manufactures of it for the past five years:

Year.	Value of Exports.
1886	$14,865,087
1887	16,235,922
1888	19,578,489
1889	23,712,814
1890	27,000,134
1891	30,736,319

The gain in the exports of leather, indeed, have kept pace relatively with the sale of the manufactures of it abroad, such as boots and shoes. But Americans possess certain important advantages in the making of leather that should give them a stronger hold in the European markets. The continental tanneries have no better facilities for getting hides, and they are handicapped by the lack of oak and hemlock bark which our own manufacturers have at hand. But, despite all this, the leather industry stands among the first in this country in dignity, enterprise, and magnitude. Important advances are yet to be made: but with the natural advantages of our tanners, their thrift and inventiveness, with a constantly expanding home market and a possible foreign one, there appears to be no reason why it should lose its relative rank.

PROPER DIET FOR HOT WEATHER.

By Dr. N. E. YORKE DAVIES.

THE Englishman is very conservative in his ideas and averse to change in his mode of life, at all events so far as his diet is concerned, and it would not be going too far to say that he is averse to change even where the change is for his good in this respect. The manners and customs of generations gone by with regard to eating and drinking, are the manners and customs of the present age, with this exception that, of course, the refinements of cookery have brought into requisition many delicacies in the way of dishes unknown to our forefathers. The maid of honor in these days does not drink, or have allowed her, a gallon of ale, as did those of the time of "Good Queen Bess," for her breakfast (it is to be hoped she did not consume it), for she now drinks tea or coffee, then unknown. But though her appetite may be the same as in those days, and doubtless even in maids of honor is, custom has altered its constituents. The exigencies of season compel the individual to dress differently winter and summer, so as to equalize the warmth of the body; and to a certain extent most people do this, but it is very apparent that it is the discomfort of feeling the cold that induces them to put on in winter a different kind of dress to that worn in summer. A man would look very absurd if during the summer and the hot months he was seen out wrapped in furs and thick clothing; but though, as I have pointed out in one or two former papers on diet, the heat of the body is better and more perfectly equalized by the food that is taken than by its external covering in the way of clothes, few people adapt their diet to any particular season of the year or its temperature. The ordinary individual eats the same breakfast, lunch, and dinner in spring, summer, autumn, and winter—the same routine of bread, meat, puddings—and the majority of the more wealthy classes consume almost identically the same food, only, perhaps, more delicately manipulated in our time by culinary art. It does not seem to enter into the calculations of the middle-class cook, or the aristocratic *chef*, that there is such a thing as the physiology of dietetics. His aim seems to be to furnish a substantial or delicate meal, pleasant to the palate, utterly regardless of the dietetic value of its constituents, and whether they are more particularly adapted to hot or cold weather. Eating is considered by many, whose intellectual attainments ought to teach them better, almost a religious duty, an irksome one, it is true, as some would say, but one that necessity compels them to perform. My own opinion is that the physiology of food should be taught the rising generation as an

important item of school life. If this were so, what a vast difference it would make in the comfort, the health, and the well-being of the individual; and with what a reserve of strength he would, if properly nourished in early life, commence his struggle with the world, whether that struggle involved physical or mental work!

In the first place, his frame would be properly developed, his brain nourished, his digestive powers in perfect condition, and he would not have in his daily work, literary or otherwise, or when old age advances, to fall back upon stimulants to give him the necessary appetite for his midday or evening dinner. Cicero says, "To live long, it is necessary to live slowly." When I say that the physiology of food should form a part of every man's, and, I may add, more particularly of every woman's education, I mean that they should know what particular use each food is applied to in the economy, and what particular food is suited for intellectual work in contradistinction to muscular work; and further, what particular food is best suited to the requirements of the system in the different seasons of the year. Fewer wives would be widows and children orphans if the mistress of a household adapted or ordered her husband's food to meet his requirements, and made it, or saw that it was made, tempting and palatable. But what obtains now in most middle-class households? The husband comes home to dinner weary and hungry to find warmed-up meat, or a washy stew, awaiting him, or, worse still, an underdone joint and half-cooked vegetables. Perhaps this goes on day after day, and year after year, until some day or other an illness occurs, and his constitution, exhausted for the want of proper food to nourish his complex organism, succumbs to it.

In the houses of the very wealthy this state of things seldom occurs—perhaps it would be better if it occasionally did, for a life of indolence and ease would be lengthened by occasional starvation. Half the illness that occurs at one season, I think I can safely say, is due to improper dieting taken at another. We hear of people feeling weak in the spring, or suffering from those different ailments due to malnutrition, such as boils, skin diseases, obesity, or debility. Now this would not be so if the person adapted his diet to his requirements and to the season. No sensible person would think of keeping a large fire burning in his room in the summer. If he did, he would undoubtedly soon feel the effect of it; but many a man who would feel himself insulted if he were not thought a sensible person, will eat in the summer to repletion foods the particular action of which is to supply heat in excess. Perhaps I can not do better here than to explain that the foods that are converted into heat—that is, keep up the

heat of the body—are starches, sugar, and fat; and those that more particularly nourish the nervous and muscular system are the albumen and salts; and a perusal of, or reference to, the following table will show what these are, and also the amounts of the different constituents they contain. At a glance the reader will see that the largest proportion of summer food should consist of green vegetables, cooked or as salads; white or lean meats, such as chicken, game, rabbits, venison, fish, and fruits.

Table showing the Percentage Composition of Various Articles of Food.

	Water.	Albumen.	Starch.	Sugar.	Fat.	Salts.
Bread	37	8·1	47·4	3·6	1·6	2·3
Biscuit	8	15·6	73·4	73·4	1·3	1·7
Wheat-flour	15	10·8	66·3	4·2	2·0	1·7
Barley-meal	15	6·3	69·4	4·9	2·4	2·0
Oatmeal	15	12·6	58·4	5·4	5·6	3·0
Rice	13	6·3	79·1	0·4	0·7	0·5
Peas	15	23·0	55·4	2·0	2·1	2·5
Arrowroot	18	....	82·0	....	....	....
Potatoes	75	2·1	18·8	3·2	0·2	0·7
Carrots	83	1·3	8·4	6·1	0·2	1·0
Parsnips	82	1·1	9·6	5·8	0·5	1·0
Turnips	91	1·2	5·1	2·1	....	0·6
Cabbage	91	2·0	5·8	5·8	0·5	0·7
Sugar	5	....	....	77·0	....	....
Treacle	23	....	....	5·2	....	....
New milk	86	4·1	....	2·8	3·9	0·8
Cream	66	2·7	....	5·4	26·7	1·8
Skim milk	88	4·0	....	6·4	1·8	0·8
Buttermilk	88	4·1	....	....	0·7	0·8
Cheese	36·8	33·5	....	....	24·3	5·4
Cheddar cheese	36	28·4	....	....	31·1	4·5
Skim cheese	44	44·8	....	....	6·3	4·9
Lean beef	72	19·3	....	....	3·6	5·1
Fat beef	51	14 8	....	....	29·8	4·4
Lean mutton	72	18·3	....	....	4·9	4·8
Fat mutton	53	12·4	....	....	31·1	3·5
Veal	63	16·5	....	....	15·8	4·7
Fat pork	39	9·8	....	....	48·9	2·3
Green bacon	24	7·1	....	....	66·8	2·1
Dried bacon	15	8·8	....	....	73·3	2·9
Ox liver	74	18·9	....	....	4·1	3·0
Tripe	68	13·2	....	....	16·4	2·4
Cooked meat, roast, no dripping being lost; boiled assumed to be the same	54	27·6	....	....	15·45	2·95
Poultry	74	21·0	....	....	3·8	1·2
White fish	78	18·1	....	....	2·9	1·0
Eels	75	9·9	....	....	13·8	1·3
Salmon	77	16·1	....	....	5·5	1·4
Entire egg	74	14·0	....	....	10·5	1·5
White of egg	78	20·4	....	....	....	1·6
Yolk of egg	52	16·0	....	....	30·7	1·3
Butter and fats	15	....	....	....	83·0	2·0
Beer and porter	91	0·1	....	8·7	....	0·2

I know that I am warring with many established opinions, and I know that the ideas I am promulgating in regard to diet

are a little contrary to those generally received; but I think I shall succeed in convincing those who will go carefully into the matter with me that many preconceived conceptions on the subject of diet will not bear investigation. Perhaps the particular condition of the system that I am called upon to treat—obesity—gives me a greater insight into the exact effect of diet than falls to the lot of the ordinary physician or specialist. To begin with, I will assail a time-honored belief—viz., that meat is a *heating* food—that is, in the sense of giving warmth, and raising the heat of the body; and that *farinaceous* foods are the *reverse*. People believe that the less meat they eat in the summer the better, "because it tends to heat the system." Now, it is a curious thing that in dieting people for the reduction of fat by dietetic means only—and this I have to do at all seasons of the year—I am in the habit of cutting off farinaceous foods, sugar, and fat, and giving large quantities of meat, green vegetables, stewed fruit, and other non-fattening substances, in quantity regulated according to the height, weight, and physical or mental work of the individual, male or female, as the case may be; with the result that in the colder months of the year people tell me that they do not feel too warm, clothe as they will. To so great an extent does this sometimes occur, that I am obliged to supplement the non-fattening diet by giving a little heat-forming food, such as cream, or a slightly increased amount of bread, or a small quantity of fat. The result is at once apparent. The body warmth becomes more comfortable. Now, what does this show? It shows that the foods that supply heat are more particularly farinaceous foods, sugar, and fat;* and this is admitted by all dieticians now. If this is so—and it undoubtedly is—it naturally stands to reason that when the external temperature performs this duty, the individual can not require so much food that will, by its chemical decomposition in the body, maintain a high temperature, and, if taken, as is usually the case, in excess, become an incumbrance by being stored as fat. It must be distinctly understood that the argument which I have used, where the heat-forming food is cut off by me, is where the surplus fat in the body is in excess—that is, in corpulency—and when it is desirable to get rid by dietetic means of the accumulated fat in the system. In this case the fat is the storehouse from which the system draws to sustain its warmth, as long as the stored fat is in excess.

A fat animal will live without food months longer than a thin one. A pig buried by the fall of a cliff at Dover was dug out alive one hundred and sixty days after. When it was buried by

* The Eskimo eats twelve pounds of fat a day.

the fall it weighed about one hundred and sixty pounds; when dug out it weighed *only forty.*

Now, with regard to the proper diet for hot weather. In the first place, we must take into consideration the occupation of the individual. A man doing sedentary work or intellectual work would not require the same diet as a person doing laborious muscular work; but this article, in nine cases out of ten, would appeal to the ordinary individual earning his living by the sweat of his brow, or, if I may so say, by the sweat of his brain. If a man earns his living by the sweat of his brain he must, if he wishes to live long, maintain his health by the sweat of his brow, that is, he must, in some form or other, take muscular exercise. He may do it by brisk walking, tennis, bicycling, shooting, hunting, or the thousand and one pursuits that the average Englishman indulges in; so that, as I said before, the diet that I should lay down as suitable for summer will, under these conditions, almost universally apply.

Nature apparently knows what is good for us, and Nature furnishes for the different seasons suitable substances in the way of food. But, of course, Nature assumes that man, being a reasonable being, should study and apply them as he ought to do; but Nature in this case credits man with attributes that in this matter he seldom possesses, or, at all events, does not care to use if he does possess them. Men do not study Nature as much as they should, at least the majority do not. If they did, they would see that in the warm weather fruit should form a considerable portion of the daily food. The most suitable articles for hot weather, experience tells me, are fish, such kinds of meat as fowls and game, green vegetables, salads, and fruit. Farinaceous food, that is, starches, should be taken in the very smallest quantity only. Sufficient sugar would be found in the different fruits that the season of the year produces, and, therefore, should not be supplemented.

In a former article on The Proper Diet for Cold Weather, I illustrated what I meant by giving one or two samples of a day's dietary for an ordinary individual, and I will here do the same. Of course, in an article of this kind it would be perfectly impossible to distinctly draw a dietary suitable to each individual. This can only be done by taking into consideration the mode of life, the idiosyncrasies, the intellectual work, the peculiarities of constitution of a particular person; but in the case of the ordinary healthy person, of course, these distinctions are not necessary. If a man is too fat, he would require certain modifications; if he is gouty or biliously inclined, slight change would be necessary; but, as I said before, to go into this would be unnecessary and out of place, and every intelligent person must alter and adapt the

dietary to his means and to his special requirements. Pope says, "The proper study of mankind is man," and, undoubtedly, if long life and comfort are to be attained, many would do well to lay his aphorism to heart. In the case of a man of ordinary size doing ordinary physical or mental work, this would represent an ordinary day's food for hot weather, as far as quantity and constituents are concerned:

BREAKFAST, 8.30 to 9 A. M.—Two cups of tea or coffee, sweetened with saccharine, one or two teaspoonfuls of cream in each; 1 oz. of dry toast, thinly buttered; 4 ozs. of grilled or boiled fish, such as plaice, sole, whiting, haddock, cod, or trout, or 4 ozs. of cold chicken, cold tongue, or of grilled steak or chop.

LUNCH, 1.30 P. M.—Two or three ounces of cold mutton, beef, or lamb; 3 or 4 ozs. of green vegetables, plainly boiled, plenty of green salad, made with vinegar, but without oil; 4 or 5 ozs. of stewed fruit; water, or 2 or 3 glasses of pure dry Moselles or other Rhine wines.

AFTERNOON TEA, 4.30, IF DESIRED.—Two cups of tea as at breakfast; nothing to eat.

DINNER, 7 to 8.—Julienne, or clear vegetable soup; 3 or 4 ozs. of fish; 3 or 4 ozs. of any *red meat*, or of chicken, rabbit, game, or venison; 6 ozs. of any green vegetable, with gravy from the meat only; 4 ozs. of stewed fruit or of raw fruit; a little stale or pulled bread, and a small piece of cheese.

This diet may be varied as to hour; but three meals only should be taken daily, and only sufficient at each meal to satisfy appetite. Fruit may be taken at other times, and any quantity of fluid, so long as it does not contain sugar; any number of pleasant alcoholic and other beverages suitable for the hot weather, and particularly suitable for those who should not take quantities of sugar, will be found in a book I wrote two or three years ago.*

Fruit is only beneficial in moderate quantity. If taken in excess, and out of proportion to other food, it is apt to derange the bowels and cause diarrhœa; more particularly is this the case if it is eaten underripe or overripe—in the former case, from its undue acidity; and in the latter, from its strong tendency to ferment and decompose in the digestive tract. Fruit diminishes the acidity of the secretion of the kidneys, and by virtue of this is advantageous in gout.

It goes without saying that more fluid is necessary in hot weather than in cold. Indeed, so long as it is a harmless fluid, I question whether too much can be taken. Fluid in this way is to the kidneys what fresh air is to the lungs, and the waste of meat not used in the system is carried off by its aid.

A meat diet is healthy and life-prolonging if supplemented with plenty of fluid to carry off its waste. That fluid should be taken in large quantities in the summer is a wise provision of Nature, as the skin carries off a large amount of waste from the

* Foods for the Fat: the Scientific Cure of Corpulency.

system, and therefore its activity should be stimulated in every way, and it is most desirable by frequent baths to keep the pores open. The perspiration drying on the skin leaves a deposit of its salts and other waste constituents, and these should be washed off as a matter of health. A very useful appliance for this purpose is the "massage rubber," patented by Mr. Crutchloe. This consists of a serrated India-rubber surface, and when used it cleans the skin of all scurf as a Turkish bath does, rapidly brings the blood to the surface, and has the conditioning effect that grooming has on a horse. The India rubber seems to act on the skin much as it does in erasing lead-pencil marks from paper, and acts in a way that no towel or brush can equal. All the old loose scurf of the skin is cleared off, and a soft and smooth surface results. After the brisk use of this *dry* rubber, a tepid bath is a great adjunct to health in hot weather, to say nothing of its cooling and refreshing results. I see a well-known man in the Hospital Gazette says the massage rubber acts like a charm in rheumatism.

It would be no use advising those who take stimulants for the sake of their stimulating qualities, that spirits and beers, and certain wines, are too heating in the summer; and that, however suitable port, sherry, spirits, and beer may be in the colder months of the year, the most suitable beverages containing alcohol, for this reason, are those known as the light, dry Moselle wines. Even claret and Burgundy contain a large quantity of tannin, and taken in excess are therefore apt to disagree and derange the stomach. Where a nice dry Moselle is drunk in fairly moderate quantity no harm can accrue. Of course, the quantity that would apply to one person does not apply to another, and a free drinker would certainly not be satisfied with less than two bottles.

The man who lives to eat, drinks after his soup a glass of pale sherry; after his fish, Rhine wine; with his joint, Burgundy and champagne; with the *entrées*, Bordeaux or Burgundy; with the ice, champagne or liqueur, and with his dessert probably some old crusted port. But the man who eats to live would be satisfied with one pint of dry and delicate white wine, such as I have previously indicated, to cover the whole of this *menu*.

It is a well-known physiological fact that the system can not assimilate more alcohol than is contained in a pint of dry Moselle or claret, or in a half-pint of sherry or three pints and a half of table beer, supposing it to be in that form; or, if taken in the form of whisky, about a wineglassful of pure whisky per day. I do not mean to say that an excess of any of these quantities would be absolutely injurious to health, and many might and do exceed them considerably for very many years with impunity; but still, in ordinary individuals, this is the quantity that can be taken with no harm whatever. In some houses people seem to

take stimulants at all hours, and only the other day a nobleman told me that, visiting a certain house, his valet came into his bedroom at ten in the morning bringing a pint of champagne. On his telling him he did not want it, his valet said, "If your lordship does not drink it, they will think you are ill!" "His lordship" did not drink it, but the champagne did *not* go down to frighten his host. I imagine gout must be a permanent institution in that household, and that the family vault must be as well stocked as the wine-cellar.

In the summer acidulated drinks are the most grateful to the palate, and in the August number of this journal last year I gave a number of these in an article called Beverages for Hot Weather. There can be no doubt that the most refreshing beverage in summer, and certainly the most harmless, is the properly made cup of tea; but, alas! how seldom does the ordinary English household in England get a properly made cup of tea or coffee! The first cup may be by chance drinkable, or it may have infused half an hour, and therefore contain all the tannin and other disagreeable and injurious products of the leaf. Now, while on the subject of tea, I should like to give a rational and sensible mode of making it for breakfast or other meal with which it may be taken. Any one walking up or down Shaftesbury Avenue, W., will see in a window half a dozen cups that he might reasonably imagine had been bequeathed the establishment by Goliath of Gath. These tea-cups are called magnums, and they hold exactly a pint, and one of them is sufficient, therefore, or more than sufficient, for a breakfast. To secure a delicious cup of tea, the proper quantity should be put into the teapot according to the number of people requiring a supply, and when it has infused nine or ten minutes —not longer—the magnum, as it is called, should be filled. This being sufficient, and equal to two large breakfast cups, is of uniform strength and flavor throughout. Its contents will please the most fastidious taste and suit the most delicate stomach. In the summer time it should be sweetened with saccharine instead of sugar, and flavored with a little cream. Some prefer tea with a squeeze of lemon-juice in it, and in this way it is possibly more wholesome and suitable as a cooling beverage.

It would occupy too great a space in a short article like this to give the most suitable fruits and vegetables for the summer months to the different conditions of the system. In a dietetic work I wrote some two years ago this subject was fully discussed,* more particularly in relation to those of corpulent, gouty, and rheumatic habit of body.

Three quarters of the ailments that humanity is subject to

* Foods for the Fat.

undoubtedly arise from errors in dieting, that is, in the quantities of food taken, in its not being adapted to the constitutional requirements and environment of the individual, in its not being properly estimated in its constituents, or applicability to the season of the year; and if, as I said at the commencement of this article, people would take as much trouble in adapting the food to suit their needs as they do in so many other things of minor importance, they would enjoy life more, and see more of it. It is astonishing what a complete change in diet will do. Change in diet acts like change in air, and is a potent factor in the treatment of those conditions that indicate exhaustion of the nervous system, and, as a corollary, general collapse. Man is something like a steam-engine, and he requires fuel according to the work he has to do. The driver of an express train does not have his engine fed as the driver of a slow train does, and so it is with the human engine. The fuel in this case should be to a certain extent adjusted as to whether it is to be utilized for intellectual or muscular work; and if this is done, a large amount of intellectual or physical work may be accomplished without strain. But if these facts are ignored, the complex mechanism on which the happiness and well-being of perhaps even a nation may depend, will collapse like a house of cards.

When the diet is properly regulated for the different seasons of the year in regard to its constituents, there is seldom any necessity to take what some people are so fond of doing, that is, purgative medicines in the spring and in autumn. A little alkaline aperient, such as the "Franz Josef" mineral water, may be taken at any season with benefit by people who live well and who are of sedentary habits, but beyond this it is a mistake to take irritating and powerful purgatives during the early spring and summer, as they are sure to set up diarrhœa that may go on for some time, especially if unreasonable quantities of fruit be indulged in. Fruit in itself is laxative in its effects, and though beneficial, as before borne out, if not taken in excess, will with some people, when more is taken than should be, set up persistent and troublesome irritation throughout the digestive tract. This was one of the evils attending the "grape cure," so much in vogue a few years ago.

In every well-appointed household, dinner is unquestionably the most important meal of the day, and a fashion in regard to this has lately crept into use, which is neither physiologically correct nor conducive to its enjoyment. I refer to the custom now prevalent of commencing dinner with some anchovy toast, caviare, or sardines on bread and butter, or some other savory of a like nature. The proper commencement of dinner should be the old-fashioned dish of good soup, and for this reason: that it

is necessary that the first food taken at dinner should be quickly absorbed, so as to stimulate the nervous system and give tone to the stomach. In this way the appetite is stimulated and the sense of taste made more keen. Nothing acts so beneficially for this purpose as a small quantity of good soup. The more important adjuncts are, of course, pleasant surroundings and cheerful companionship.

Contrast the exhilarating effect, say, of a dinner at the "Grand," at Brighton, under the superintendence of its accomplished and obliging manager—with the open sea, and ever-varying kaleidoscope of life to gaze at—with the same dinner in a dull country hotel. Addison says, "Health and cheerfulness mutually beget each other." They undoubtedly do.

To maintain life at its highest standard and for the longest period should be the aim of every individual, and this can only be done by adapting our food to the requirements of the system and the time of the year. If the body is properly nourished, disease will not attack it; and if it does, will get no foothold. It is like an impregnable fortress—it may be assaulted, but it can not be taken.

But to get the economy into this state of perfection, it must be remembered that no more food should be taken than will be consumed in the operations of life, and no more stimulant than the amount previously indicated, so that no surplus of either shall remain in the body in the shape of excess of fat, or as waste, in the form of gout poison or acidity.

"Gluttony," says an old writer, "kills more than the sword." On the other hand, there is no reason why food should not be made as palatable as possible—in fact, the more palatable it is the better. It is not excess in variety of food that is injurious, but excess in quantity.—*The Gentleman's Magazine.*

In his account, in the Australasian Association, of the natives of New Guinea, Mr. J. P. Thomson spoke of their numerous tribal divisions and of the various languages and dialects spoken by them. Even in localities separated by only a few miles, the dialects spoken differ the one from the other in some cases considerably. The Motu, which is the language spoken and taught by the missionaries at Port Moresby, is understood over a considerable area, but outside of that neighborhood changes and variations occur, so that at the head of the Great Papuan Gulf and in the Fly basin, the Motu language is a foreign tongue. In other parts of the island, also, the philological variations are numerous and conflicting; and in the western division neighboring tribes are unable to hold intercourse with each other, even if friendly, by reason of the incompatibility of language. No doubt this may in some measure be accounted for by local environment; constant civil intertribal war is the means of isolating communities, so that no friendly intercourse is held; an incongruity of language may have been unknowingly established by reason of this and other causes.

KINDERGARTENS—MANUAL TRAINING—INDUSTRIAL SCHOOLS.

By Mrs. H. M. PLUNKETT.

IN 1877 a prominent Chicago law firm advertised for an office-messenger. In response, more than six hundred college-bred and academy-taught boys applied for the position. In the same year, in the same city, a man engaged in trade put a very inconspicuous advertisement—with no indication that his was a large and old-established house—into an inconspicuous column of a daily paper, calling for the services of an office-boy and messenger. More than three hundred answers were received—many of them from grown men, some of them coming into the category "educated" as commonly understood. Much later than the above date, the position of book-keeper and confidential clerk to a down-town merchant in New York suddenly became vacant. He advertised; more than two hundred applicants responded. "Which one did you take?" queried the person to whom he was relating the incident. "Not any of them; for the fact was that, on my way to my business, I learned of the sudden death of a man in a business similar to my own. I knew that his affairs would have to be closed up, and I knew that he had just the man I wanted—one who understood the ins and outs of the business to perfection; so I just stopped and told the clerk, who was at the moment closing up and putting crape on the door, that when he was at liberty I wished an interview with him, and I thought it might result to his advantage. In a few days he came, and he suits me to a dot." One of these cities it will be noticed was in the young and growing West, the other was in the older and presumably more crowded East.

No doubt these incidents can be matched in most of the large cities of the country, and what is their moral? What message do they convey to the well-wisher of his country or his race? What was the matter with these so-called "educated" men that they could find no place in one of the busiest spots on earth; and why did the merchant ignore his two hundred replies?

Perhaps we need to revise our ideas of what education consists in, and certainly the merchant demanded *trained faculty*, and instantly seized upon it because he knew that he was getting it.

College education, simply of itself, no longer gives a man that pre-eminently superior position that it once did; in addition, he must be able to bring his faculties to bear among the practical and pushing men by whom he is surrounded, or he will be relegated to the limbo of learned incapables, whose pathetic stories come to the surface daily in the column "Situations wanted—males."

The first step in rectifying an error is to probe and analyze it, so as to discover its real nature and dimensions, and the inquiry at once arises, Were those six hundred men really *educated*, or had part of their powers, and perhaps the powers best worthy of cultivation in each individual case, been ignored, or neglected through giving undue attention to the so-called purely "intellectual faculties"?

It may be said that this great army of the unemployed ought to disperse, and betake themselves to the abandoned farms that are crying out for owners and cultivators; but they would be just as helpless and unadapted there, for the simple reason that the taste and skill for farming need to be acquired in youth, and these poor creatures are best described by a word used by a countryman in apologizing for his wife's shortcomings as a housekeeper, "She means well, but she ain't noways *faculized*."

There has been a silent revolution going on for the last fifty years through which a "college education" has been deposed from its position of prime fetich among English-speaking people, and a new set of men—happily named captains of industry—are making their way to the front rank. Never was it truer than to-day that "new times demand new measures and new men," while it is being discovered that, even for the highest development of what are termed the purely intellectual faculties, book-learning and those studies that can be pursued in the isolated cloister or seminary are not all-sufficient. We are standing in the dawn of a new day, in which the term *manual training* is coming into universal use, and we are destined to hear much more of it and learn much more of its relations to the well-being of individuals and the body politic in the near future.

Between the years 1800 and 1830 a spirit may be said to have been moving upon the waters, in several countries at the same time, to effect a revolution in men's ideas as to the capacities for improvability in man, and the means by which these capacities can be developed, till at length, what may be called the gospel of culture was initiated. Twenty years before the French Revolution, Rousseau had put forth his Émile, a hand-book on education, which was one of those germinal, potent books that, though burned in France, was a seed that brought forth a hundred-fold when it was dropped into the minds of Pestalozzi in Switzerland and Goethe in Germany: it led them to study the human faculties in a new way—to take cognizance of the physical nature, as the concomitant if not the basis of sane and profitable action in the mind. Those men died nearly at the same time, and when England was on the verge of a mighty industrial upheaval; and as the torch of wisdom fell from their relaxing hands, it was caught up in England by men who were scourged to action through fear

of a terrific crisis. Its light shot across the Atlantic to safe and peaceful America, and a new style of teaching was inaugurated—largely through the influence of Horace Mann; but this again was improved upon, and brought more into harmony with the fundamental laws of mind by Froebel in Germany—one of his most earnest American propagandists being the venerable Miss Elizabeth P. Peabody—and now it seems as if his ideas are on the verge of universal realization.

In 1831–'32 England was in a state of ferment; incendiaries kept the country lighted up by a line of blazing hay-ricks from county to county, cattle were poisoned or mutilated, and every day brought news of some fine machine broken up by the factory people, as a devouring monster that had come to eat the bread out of their mouths, and the real oppressions and fancied injuries of the factory population had become so unbearable that Parliament could no longer remain apathetic and supine.

In 1833 a commission was appointed to examine into the condition of the labor of young persons and children employed in factories. The commissioners found generally that the children were worked during the same stages as adults—eleven, twelve, or more hours daily—and this long-time labor had practically excluded the children from the means of education, so that a population had been growing up deteriorated morally as well as physically by excess of labor. Sir Edwin Chadwick was charged with the work of drawing up a bill that should remedy the evils of their condition. The commission declared that six hours of daily labor was all that young children could endure without permanent bodily harm, and insisted that manufacturers enforcing work during those long hours should do it with double sets of children, six hours to each set. The provision which Mr. Chadwick proposed as an efficient protection to these little factory slaves against exclusion from education was, "that it should be a condition of the employment of children by the manufacturer that every child so employed should produce a certificate from a competent teacher in a fitting school, certifying that the child had been under instruction three hours every working-day during the week preceding; three hours being half the time then generally occupied in the working-schools. Hence the name "half-school-timers," which soon shortened into "half-timers." These three hours' schooling—much of it in inferior or nominal schools—was primarily intended as a security from overwork, for it was reasoned "Three hours in the school-room keeps them out of the workshop three hours," and the immediate effect, as testified by competent medical men, was a better growth; and, quite unexpectedly, employers admitted, a better quality of work. But, over and above these results, there came out of these inves-

tigations and measures some surprising revelations and practical results, which eventually affected the whole of the prevalent practice of infantile and juvenile training and education. The graded school and the trained teacher were partially the incidental outcome of a work primarily undertaken to rescue mentally and physically the young factory slaves. There were a few enlightened and humane employers, permeated with the progressive spirit of the time, who established schools in connection with their works, and there were some good schools kept by trained teachers in the large manufacturing towns, as at Manchester and Oldham, where the half-timers could be sent. Mr. Chadwick made a careful study of the best conditions for mental work among twelve thouands pupils, during a period of twelve years, and has left on record some very surprising but accurately thought-out conclusions. He thinks that alert voluntary attention is the only profitable attention, and he is sure that "three hours is as much time as can be occupied profitably with any subject-matters of instruction, with very young children," but it was found that the half-timers got a superior habit of mental activity, so that employers came to prefer short-timers to long-timers, and the military drill that had been introduced in the schools resulted in such superior bodily aptitudes that the stunted pauper boys of town got the preference over strong, robust rustics from the coast; but the most surprising result remains to be stated, for it soon began to appear that in mental attainments the half-time factory boy was in advance of the pupils of the board schools of the same age, the factory boy attaining the fourth standard by his tenth year, while the "long-time" board scholar reached it in his twelfth or thirteenth year.

In 1882, after half a century of observation and experiment, Mr. Chadwick summed up some of the defects of the current systems in words too apt to be improved upon. He says: "Unfortunately, the primary principle of education, the capacity of the recipient, *the mind*, is not understood or regarded. . . . The receptivity of the minds of the great mass of children, for direct simultaneous class-teaching—the only effective teaching—is less than three hours, and where these limits are undistinguished and disregarded, the consequences are displayed in wearisome efforts, as it were, to get quarts into mental capacities of pints and gallons into quarts, with prolonged sedentary detentions for this foolish purpose, and with grievous bodily as well as mental injury."

Meantime, educators have now settled these points:

1. The inadequacy of the old-fashioned college education to enable the average man to take and hold a place among the world's needed workers—those six hundred applicants in Chicago prove this.

2. They have entirely changed their views as to the relation of the bodily powers to mental training; and—

3. They have changed their views as to the right time in which to lay the foundations of moral character.

While these advances were being made in the science of pedagogy the human body—as a means of development for the mind and soul—began to be discovered; and, instead of its being regarded as a mere shell or scaffolding wholly outside and apart from the unseen nature, it was found out that the "sound body" in which the wisest of the ancients lodged their "sound mind," had much to do with the growth and perfection of the spiritual nature.

In April of 1891 some of the leading educators of this country held in Boston a conference on manual training; and we make no apology for copious extracts from the phonographic report of their addresses, as they contain the latest utterances of the persons best qualified to speak on the theme we are considering.

Said President Eliot, of Harvard: "The wisdom of my parents caused me to be taught carpentry and wood-turning before I was fifteen years old—while I was yet a member of the Boston Latin School. It has been of great use to me all my life, and a great pleasure. Then, later, after graduating at college, I became a chemist by profession. I studied that difficult science for years, and then I taught it for years. In every science a great deal of manual skill is necessary for the student and the teacher. The progress of the world in natural science during the last century has been greatly due to the trained senses—eyes, ears, noses, and fingers—of the experts in those sciences.

"Then for the last twenty years I have seen that one of the great improvements which have been wrought in education in all civilized countries has been the individualization of instruction so as to meet the precise needs and develop the capacities and powers of each individual, at each stage of his development.

"I am old enough to remember when the brain was supposed to be the seat of the mind, just as the lungs were held to be the furnace that warms the body. I remember being taught that the animal heat was kept up in the lungs, but we all know better now; we know now that whenever an atom is consumed, in whatever part of the body, there heat is generated, and therefore that the animal heat pervades the whole organism. It is just so with regard to the human mind: it pervades the body. It is not in the head, but it is all over the body, and when you train the hand or the eye or the ear, you train the mind: manual training is mental training. Never admit that manual training is anything distinguished from or in opposition to mental training. In the skill of the artist's hand, in the methodical, accurate movement of the

mechanic's arm, in the acute observation through the physician's eye or ear, there is always mind. We are, in manual training, simply training another kind of faculty—not memory, but discriminating observation and correct perception. The old-fashioned education was chiefly devoted to the training of memory; most of the work in the grammar school to-day is memory-training. I am thankful for every effort to train our youth to correct observation, just discrimination, and accurate measurement.

"There is another value in manual training in that it trains the mind through success, through achievement, through doing something tangible and visible and doing it well. When a boy has planed a parallelopiped of iron so well that no light shows under the edge of his try-square when he applies it to the faces of the block, he has done something which demands patience and care and attention, something which he can prove to be well done —something which he be proud of. There is mind in such work, and there is also sound morality in it."

Sir Edwin Chadwick says: "It is proved practically that the physical training in the school stage, giving the use of hands, arms, eyes, and legs, is giving aptitudes for *all* industrial occupations"; and, also, in commenting on the military drill as introduced largely through his influence in the public schools in England: "The physical exercise in the military drill is a visible *moral* exercise in all that is implied in the term discipline—viz., duty, obedience to command, order, self-restraint, punctuality, and patience. There is good and bad elementary moral education, as shown by the outcome, and especially by the outcome of the half-time system of education; but the half-sedentary or intellectual and dogmatic education, and the half-physical, has now been proved to be far more successful than any other system yet known or practiced."

The eminent manual instructors all over the country echo this experience, as above set forth, by two of the foremost authorities among English-speaking people.

During the last twenty years, and especially during the last ten, the great army of Christian men and women, who have been striving to uplift humanity, have been revising and modifying their views as to the *best time* in which to begin setting young feet in those right paths that shall lead them to usefulness and happiness; and the general consensus of opinion is that between the years of three and six is the most precious seed-time for the implanting of moral principles—that then is the time for "bending the twig" effectively. One of the men in New York of the largest experience among the children of the neglected and criminal classes says, "We find that all we can do for their moral im-

provement must be accomplished before they are twelve years old, and we find that the earlier we begin the better."

An instrument seems to be provided in the *kindergarten*, in which a thoroughly thought-out science of instruction adapted to the child-mind is put in practice with children as soon as they show a longing for the companionship of other children; it is an institution which bridges over the chasm between the nursery and the school.

Philanthropists, looking at human material as a whole, perceive that true economy of force concerns itself with forming, thus preventing the need of reforming. It can be demonstrated from the money standpoint alone, leaving out of view the inevitable misery involved in the latter process.

In New York city there are now 142,519 children under five years of age whose homes are in the tenement-houses. The latest report of the New York Kindergarten Association states the cost of conducting a kindergarten of fifty pupils at fourteen hundred dollars per annum—twenty-eight dollars per capita. At the Elmira Reformatory it costs one hundred and eighty-eight dollars per annum to support one of these children whose manual and moral training has been neglected after the commission of some crime has placed an indelible stain on his name. Mr. Brockway states that very few of these young burdens on society have "any acquaintance with any craft requiring skilled labor, and their parents are just as deficient"; so that the earnest men and women who are now striving to lift the metropolis of the nation toward the level already attained by Boston, San Francisco, St. Louis, and a host of other cities by the establishment of free kindergartens, are taking possession of the largest and most hopeful missionary field still lying unoccupied under the broad arch of heaven. Mr. Gilder truly says, "Plant a free kindergarten in any quarter of this overcrowded metropolis, and you have begun, then and there, the work of making better lives, better homes, better citizens, and a better city."

Pestalozzi saw that the moral forces of the human soul—feeling and will—require to be dealt with in a manner analogous to the cultivation of the intellectual faculties, that a training school is needed for the moral side of cultivation—one in which the power of moral action may be acquired. He said, "There must be a definite system of rules by which always without exception a firm will may be produced"; and the Baroness von Bülow adds, "The development of children into men and women must be brought under the laws of a well-considered system, which shall never fail to accomplish its end, viz., the cultivation in them of a firm and invariably right will."

In discussing the necessity for the kindergarten, physiology and

psychology unite in crying out against the waste of the years from three to six. Says Prof. Bain, in his Education as a Science: "The brain grows with great rapidity up to seven years of age. It then attains an average weight of forty ounces in the male; from that time it grows, but at a diminishing rate, till twenty, when it has nearly attained its greatest size." It would seem pretty clear that there is some connection between intellectual power and brain-growth. Whatever it can take hold of, it can fix and ingrain with an intensity proportionate to its rate of growth, and we begin too late if we allow time to pass by when good and useful impressions could be made with perfect safety to physical and mental health, and nearly all thoughtful teachers and psychologists agree that for certain classes of impressions the first six or seven years of life are worth all the rest put together: it is at this period that curiosity to see and to know is at its intensest."

In the town of Christchurch, England, we hear of children under six put to making the delicate chains that connect the mainsprings of watches to the works, because when older their fingers are too large and clumsy; and of still smaller ones in London who are made to rub in the nitrate of silver used in dyeing sealskins, because their tiny slender fingers can pass effectively in and out among the hairs; but there can be no delight in this work to the poor child-slave, such as is felt in the kindergarten, where, seated at a table in company with others of his own age, the child plaits strips of straw or leather or colored paper, or models from clay a nest of birds and its eggs, or forms a miniature house and garden and fence, from pretty materials after a pattern of his own designing, in which his mind has passed through the natural stages of perception, observation, comparison, judgment, conclusion, and production. Then a pretty song, descriptive of some incident or process, in which all join, is followed by mild gymnastic exercises adapted to the childish frame, and thus, as the Baroness von Bülow says: "In playful work or workful play the child finds a relief for, and a satisfaction of, his active impulses, and receives an elementary groundwork for all later work, whether artistic or professional." Many of the articles made are intended as special gifts for some birthday or for Christmas, or they are sold to procure the means of dressing a Christmas tree for some poor or sick child, for it is one of the fundamental principles of the system to teach the child consideration for others, and also to give him a true respect for useful work—"work which is at the same time a fulfillment of duty is the only true basis of moral culture." But it is necessary that such work should satisfy the child's instinct of love, and the object of it must be to give pleasure to others, and a system of education such as is demanded

by modern times should make work such as shall connect artistic dexterity with the cultivation of intelligence its basis. A writer in the Philadelphia Times, commenting on the public-school "education" as conducted mostly hitherto, says: "Nine tenths of the young criminals sent to the penitentiaries have enjoyed school advantages, but three fourths of them have never learned to do *an honest stroke of work.* Our children have their poor little heads crammed full of all kinds of impossible knowledge of names, of dates, and numbers of unintelligible rules, until there is no room left to hold any of the simple truths of honor and duty and morality." The military trainers declare that they obtain in the very infantile stages (five years) a better drill than they do or can get afterward, and Chadwick says: "The drill conduces to qualities of a high moral order and value, denoted by the terms discipline, patience, order, self-restraint, prompt and exact obedience. Children so trained learn to move quickly together and to pull together, and exert force with fewer hands."

It would thus seem that three of the most valuable years of a large majority of our children have hitherto been allowed to run to waste, and, as the educational policy of a country should be directed toward developing all its intellectual wealth, a movement which seems to be "in the air," that will eventually graft the kindergarten on to the common-school system of the whole country, should be hailed with joy by the patriot and philanthropist.

There are already thirty-nine in St. Louis in connection with the public school, thirty-eight in Philadelphia, twenty-two in Boston, twenty-two in Milwaukee, and from five to twelve in other cities. If a good many thousands of the unoccupied young women of the land would learn to be first-class kindergartners, and each, gathering a dozen or more of the neglected children now crowded out of the schools about themselves, and bestow some of their unused capacity for "mothering" upon them, what a prophylactic it would be against the corrupting "reformatory" in later years, and perhaps the penitentiary!

Now that really wise and discriminating educators affirm that, in the time beyond the kindergarten years, the use of the hand is not antagonistic to intellectual achievement, but rather promotive of it, we are beginning to hear the phrase *manual training* on every hand, the more because that, for successful *puer*iculture as a factor in national life, we must, as Chadwick says, "add to the science of the physiologist and the psychologist that of the political economist, by whom man is regarded as an intelligent productive force"; and in another stage to which we are advancing—that of the general use of machinery—Jules Simon defines man as "an intelligent director of productive force, valuable to the extent and

quality of its yield." Five thousand persons are killed by steam power and machinery in England and Wales annually. Sir William Fairbairn says: "These deaths are mostly occasioned by the ignorance or clumsiness of the hands to whom machines were intrusted; occurring singly as they do, and making monotonously similar newspaper paragraphs, we become brutalized and fail to take in the enormity of the destruction." America could show no better record; it is as if ten times the number of persons who make up both Houses of Congress should be brought together and visibly blown to pieces, scalded, and crushed, by bodily clumsiness and defective training. In England, for lack of the kindergarten or infant school, fifteen hundred children are scalded or burned to death each year, and probably more in America.

What is manual training? It is the subjugation of the hand and arm (an appendage of the head) to the direction of the brain, so that they shall touch some definite point, or exert some definite measured force, in obedience to the will, at the exact instant desired.

When should it begin; and what are likely to be its effects on the common weal?

The human hand is, of all instruments, the most wonderful. Sixty years ago Sir Charles Bell, the great anatomist, who discovered that the nerve filaments of sensation are distinct from those of motion, wrote a volume on The Hand, its Mechanism and Endowments, as evincing Design. In the intervening years so much has been learned of the relation of the nervous elements to the muscular fibers which they animate and control, and so much of the effects of the interaction of the brain and hand in those processes which we call "reflex," that another and most interesting volume might now be written on the hand in these aspects. It has been definitely ascertained that there are certain limited areas of the brain which control and direct the motions of certain limbs and no other; and as in the production of certain definite motions—e. g., those used in sewing or piano-playing—this definite related area of the brain is called into exercise, why may not its repeatedly being aroused to action promote its growth and perfection as surely as exercise of the blacksmith's muscle causes its growth and the perfection of its finely compacted fibers?

But, speculations aside, experience proves that the education of the hand can be begun at three years in the kindergarten, so that the child, whose supple and growing fingers have been taught to move in definite directions for definite ends, has at six a long start in manual dexterity ahead of the child whose maturing joints have been neglected. Our great-grandmothers taught their daughters to make "fine shirts for papa," neatly and thoroughly, at what seems to us an incredibly early age; and now that the hand

as an element in human development is again being discovered, it is interesting to find that the highest specimens of plain sewing, shown as "prize exhibits" in the public schools where sewing is taught, is a tiny pair of old-fashioned shirt sleeves, made with straight, doubled and stitched wristbands, gussets overhanded on and felled, and neat gathers, made by the formula "skip four, take up two," and "smoothed" *secundem artem.* The girl who never uses a needle till twelve years old can not become a facile seamstress. Every one is familiar with the early age at which professional acrobats commence the training of their children. There may be an inherited muscular aptitude, but the parents do not rely upon that to make their son into an "infant prodigy." No one needs be told that musical performers must get the music "into their fingers" before they are stiffened and full-grown. These persons illustrate best of all the subtle, inexplicable connection between brain and hand. What undivided attention does the neophyte give to the striking of each separate note on the piano. Those who have listened to much "practicing" know how tiresome it is, until by unremitting iteration and repetition there comes a day when, lo! the fingers glide over the keys, touching each minutest fraction of a note perfectly—each in obedience to its own nervous impulse—while perhaps the performer is answering your questions on an entirely irrelevant subject. Mozart had absorbed a knowledge of music by listening to the lessons given his sister Maria, and had undoubtedly experimented by himself till at four he played the piano with ease and expression; and his father having given him a small violin at six, he learned by himself how to play it, so that before he was seven he played his part in a trio, reading at sight without mistakes or hesitation. The musicians certainly know the value of manual training and give a fresh emphasis to the old adage "practice makes perfect." Rev. Dr. Parkhurst, in commenting on the accuracy of aim with which David's stone "smote the Philistine in his forehead, that the stone sunk into his forehead," an aim that presents itself to many minds as supernaturally aided, said: "*But it wasn't his first stone;* he had practiced while out there on the plains of Bethlehem watching his father's sheep, and the unerring shot was the legitimate result of long training."

There is another aspect in which the introduction of machinery needs to be considered by his country's well-wisher. In the Boston Conference on Manual Training, Colonel C. W. Larned, of West Point, said: "There are altogether too few men in the world who are skillful to do with their hands—not to talk, or to write, or to imitate—but to perform with skilled faculties; the eye of that much-traduced creature, the average man, is becoming more and more dull and indiscriminating, the hand increas-

ingly unapt and inexpert. The more machinery and the artificialities of life relieve the individual from the responsibilities of physical action, the more the faculties will suffer from atrophy, for the reign of the machine has a dulling effect upon the general acuteness of the physical faculties that must be progressively felt, unless education systematically counteracts its influence; and it is the function of industrial training to do this for the hand-worker."

But the greatest injury which comes to the body politic through neglect of training in the most impressionable years is the failure to impart moral ideas, and to secure habitual obedience to moral laws—lack of character-building. The half-time schools of England have been so long in operation that their statistics furnish conclusions of the highest value; and, that book-learning is no guaranty of the moral worth of its possessor, look at the criminal returns for London for one year. The education of some was "superior"; among the criminals there were more than a thousand clerks, forty-two lawyers, and many more who had received the usual middle-class, long-time education. The appearance of a half-timer trained on the mixed principle of physical and mental training is exceedingly rare, that of persons from some of the religious denominations equally so—showing the thoroughness of their moral teaching; while the governor of one prison said, "The greatest rascal I have in custody can write out our Lord's prayer in seven languages." The ancient Jews—while still living in Palestine—had a maxim, "He who does not teach his son a trade teaches him to be a thief." Mr. Chadwick collected some facts that should bring great encouragement to those who have been moved to labor for the salvation of the slum-born children of the criminal classes. It was shown that in some of the long-time middle-class schools twenty per cent of the pupils were disqualified from obtaining positions by misconduct; while among pupils of low parentage in good half-time schools, these dismal failures averaged only two or three per cent; and that, too, where, before the establishment of such schools, the average had formerly been as high as sixty; and a manager of one of the district half-time schools stated that he had had cases of habitual criminality to treat—that in a few months a great alteration in their characters had taken place through their industrial training. I asked if, say, a hundred such were committed to your charge, how many could you undertake to send to the good?" He said, "With fair support, I would undertake to send ninety per cent to the good."

Under the restraints of separate confinement in the prison the thoughts of the young criminal are not compunctious visitings for wrong-doing, but of his ill luck, and the chances of escaping

detection in ill-doing when he gets out; and this child of the beggar or thief, with no skill in hand or arm for work, sees no way but to do as he has done before. In the half-time industrial school he is placed under new conditions, by which good thoughts are impressed from day to day to the exclusion of bad ones: he becomes grounded in the primary moral principles of attention, patience, self-restraint, prompt and exact obedience; hope springs up in his poor crushed soul, as he gets interested in his work and does it with a will. There is enough accumulated experience in England and America to warrant the statement that the most profitable investment that can be made in "futures" is in those of the living children of the country by making the kindergarten and manual training part of the public-school system throughout the broad land. It would undoubtedly add much to the cost of education, but it would be more than offset by lessening the cost of reformatories and the support of criminals. More, it would afford useful and congenial employment for thousands of women—for it is really impossible to imagine a man's becoming a successful kindergartner; the teacher in that school needs to be endowed with the divine instinct of motherhood, and succeeds because she follows it, just as a good trained nurse succeeds through her inherent I-must-care-for-somebody characteristic. A doctor of wide experience predicts that the movement for the training of masculine nurses will be a comparative failure, simply from lack of this foundation element in the pupils. There are now good training schools for kindergartners, where all that can be imparted by teaching, to supplement natural ability can be learned; and we venture to declare that the most promising missionary field in the world is to be found on the outer fringe of our large cities, where in a narrow tenement the mother has her *creché* on her lap and her "kindergarten" and her "primary" and "secondary" pupils at her side, all under the age to be admitted in the public school. What more natural, when the smallest goes to sleep, than to send the others into the street, where they must perforce learn its evil lessons? In the city of New York there are many thousands of these children. Suppose that one thousand young women, well instructed in the art of teaching according to Froebel's system, should each gather about her a score of these undisciplined waifs, teach them till they were six, and then pass them on to a school where manual training is mixed with "book-learning" in the measures experience has demonstrated is wisest, to be taught till twelve—it would result in the greatest salvation from evil, and in the greatest addition to the working capacity of the generation, that could be made.

In 1870, at the solicitation of Miss E. P. Peabody, the Boston School Board established a kindergarten and conducted it for sev-

eral years; but it was to another woman's enthusiasm and her private munificence that the cause was to owe its conquering impulse. In 1877 Mrs. Quincy A. Shaw opened two; and from time to time others were added, till in 1883 she had established in Boston and its vicinity thirty-one. In 1887 the Boston School Board, having become convinced of their value, incorporated fourteen as part of the public-school system, and others have been gradually added, till now it has thirty-one, with an attendance of nearly two thousand children. But this children's crusade is by no means confined to Boston; there are kindergartens and manual training schools in St. Louis, in Philadelphia, in San Francisco, and, in short, they are taking root all over the country. Nowhere are they so much needed as in New York, where there is annually so much ignorance dumped from abroad; but, until there is not a single score of neglected, untaught children left unreached by this beneficent agency, let us hear no more wailings over superfluous womanhood. Where is the practical philanthropist who desires to leave noble men and women as his monument, who will supply the funds needed to rescue these children, while the municipal authorities are waiting to be convinced of the utility of not opening the stable-door at all, when thieves are about?

If there is such a waiting benefactor of his kind, there is plenty of accumulated experience to guide him in the choice of instruments. Lest those who have failed in other fields should fancy that here is a niche that they can fill, let them understand that it needs a high order of talent to succeed here. Mr. Chadwick says, "Those who have given earnest study to primary education are aware that the highest training power should be applied in the most formative period—the infant-class"; and in the report of the Boston conference we read, "One strong feature of Mrs. Shaw's management, perhaps the one which raised the educational value of the Boston kindergartens, was the extreme care exercised in the selection of teachers"; and whenever the kindergarten is to win its way, this care must be exercised. In 1883 she induced two kindergartners of St. Louis, each excelling in a special line, to come and give advanced courses to her teachers, and these were supplemented by lectures, teachers' meetings, etc.

Manual training—still in the dawn of its development—has come, and come to stay. It will enhance the respect due to honest labor, and go far to cure the disease of "millionism" from which we are just now suffering; and those who look to the Scriptures for guidance will remember that the brilliant reasoner and follower of the carpenter's son, St. Paul, was a tent-maker, who called the elders of Ephesus to witness that "these hands have ministered to my necessities, and to them that were with me."

TWO RARE MONKEYS.

By Dr. L. HECK,
DIRECTOR OF THE ZOÖLOGICAL GARDEN IN BERLIN.

THE slender and the short-thumbed monkeys belong, in the truest sense of the word, to an old simian family. The fact is demonstrated as to the Indian slender monkeys, for indubitable representatives of this genus (the *Semnopithecus*) lived in the Tertiary period.

The form of the skull gives the slender and short-thumbed monkeys a peculiar appearance. It is roundish, the snout advancing but little in front of the forehead, and the bony crests and edges, which often give the skull of the male an appearance like that of a beast of prey, are hardly distinguishable. In a corresponding way the jaw is relatively only slightly projecting, and less obvious in the slender than in the short-thumbed monkeys. The entire skeleton in both groups is distinguished by the slenderness and lightness of its form, from which the slender monkeys get their name. The name of the African short-thumbed monkeys relates to a peculiarity of their bony structure, in that the thumbs of their fore limbs are not visible externally except as stumps; and, while in the slender monkeys, too, the thumb is behind the other fingers in development, the complete arrest of it in the others has been held sufficient to mark a distinction between the two families. On the other hand, I find a peculiarity of the skeleton of the slender monkeys mentioned in only a few descriptions, and in those casually, which appears to me as doubly striking in the monkeys as climbing animals, and is not elsewhere repeated in them, at least in those of the Old World. It is that the slender monkeys have much longer and thicker hind legs than fore legs; the development of the hind limbs evidently surpasses that of the fore limbs; and this occasions characteristic deviations in the attitudes and movements of the animals, as I have observed daily with my pets. The slender monkeys run half erect with their hind legs bent up, and make great leaps from this position direct. Thus, notwithstanding their great agility, they have something hasty and angular in their motions, and maintain so peculiar a gait that any one who has studied them continuously in living specimens can distinguish at a glance whether a picture of them is made from life, or whether it has been constructed by adding a few special outward marks of the slender monkey to the figure of a common monkey. In their inner structure the slender monkeys and the short-thumbed monkeys have a highly important peculiarity, unique in its way, in the shape of a composite, divided stomach, suggestive of the ruminants, or rather of the kangaroo,

FIG. 1.—WHITE-BEARDED SLENDER MONKEYS.

which is sufficient, in my opinion, despite some special differences, to characterize them as closely related. This peculiar structure of the stomach, unprecedented in a monkey, naturally induces the presumption of a peculiar method of feeding, and indeed shows indubitably that the slender monkeys and the short-thumbed monkeys are more fully and exclusively vegetable feeders, or, to be more exact, greens-eaters, than the other monkeys. This inductive conclusion is fully confirmed by observation of the animals in captivity. Our representative of the short-thumbed monkeys, the *guerezas*, as well as the two species of short-thumbed monkeys which I have tamed, eat regularly but daintily of the hay that serves them for straw and bedding, and the guerezas eat with particular relish the heads of green salad which they have learned to expect eagerly for

their daily supper. In outer general appearance, which is chiefly dependent on the character of the hair coating, the slender and short-thumbed monkeys exhibit some important peculiarities which distinguish both groups, while the Indian slender monkeys generally have a short fur and their hair makes a conspicuous growth only in spots in the shape of head-tufts, manes, whiskers, and gorgets. The African short-tailed monkeys are distinguished by a long, luxuriant hair covering over the whole body, the effect of which is enhanced by handsome and conspicuous markings. The more delicate differences of hairiness, coloring, and marking serve, in both groups, to fix the distinctions of a considerable list of species. We shall confine ourselves chiefly to the species represented in the pictures.

First, we have the two comrades so pleasantly sitting together on the limb in Fig. 1. They are White-bearded Slender monkeys (*Semnopithecus leucoprymnus,* Desm.) of Ceylon, the single species which has been brought to Europe with considerable frequency, and which is therefore easily found in the zoölogical gardens. This harmless, quiet, gentle animal is easily distinguished by its external appearance, which is felicitously in harmony with its name. It has a white cheek-beard, with the tips of the hairs turned forward. The lower part of the back and the tail are grayish white. The rest of the body is brownish black, while the hair on the head is longer and more distinct. Sailors can always buy these monkeys cheaply in the port of Colombo, and they are probably common on the island.

In Fig. 2 are moving some representatives of a famous species of monkey, the Hulman or sacred monkey of India (*Semnopithecus entellus,* Cuv.). This monkey is accredited with having performed great acts of heroism in primitive times. It is in the Indian mythology a kind of Perseus and Prometheus in one, inasmuch as it delivered a goddess from captivity to a giant, and used its opportunity to give to India, not fire, but the mango. It extinguished the funeral fire on which it was to have expiated its rash adventure, and therefore appears now with singed face and black hands. The rest of its body is colored a whitish gray; on its forehead, cheeks, and chin it wears long, stiff, bristling hairs, out of which, as from a frame, peers the round black face with a lively and peculiarly droll expression. The pious Hindu, who will kill hardly any animal, of course does as little harm as possible to his ardently revered monkey-saint, but gives it freely of the fruits of his gardens and fields. He even in a literal sense lets it take the already prepared meal from his own mouth. Through the credulous simplicity of men, which has permitted them in quiet acquiescence from time immemorial to do their pleasure, the hulmans have become so bold and impudent that

they go into the houses as well as into the gardens and steal, plunder, and destroy at their hearts' desire. In many parts of India they have become a real plague, and the English officers are at times obliged, in order to limit the nuisance, to proceed against the tail-wearing saints with destructive measures, to the joy of the enlightened, intelligent natives, but to the disgust of the

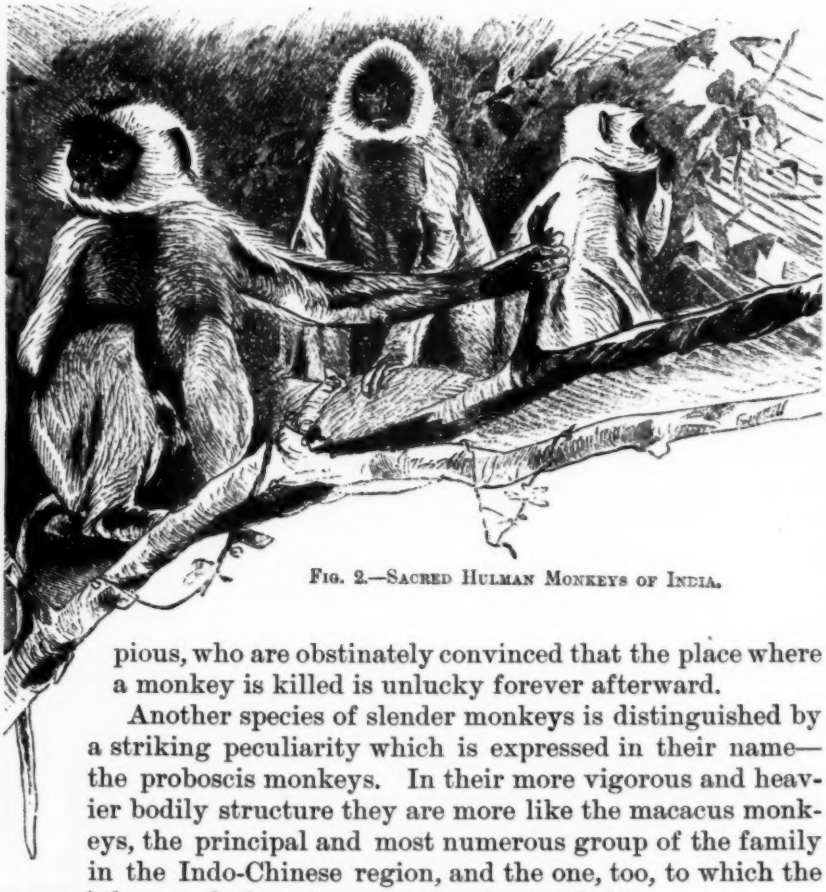

FIG. 2.—SACRED HULMAN MONKEYS OF INDIA.

pious, who are obstinately convinced that the place where a monkey is killed is unlucky forever afterward.

Another species of slender monkeys is distinguished by a striking peculiarity which is expressed in their name—the proboscis monkeys. In their more vigorous and heavier bodily structure they are more like the macacus monkeys, the principal and most numerous group of the family in the Indo-Chinese region, and the one, too, to which the mass of the population of our monkey-houses belong.

The proboscis monkey (*Semnopithecus nasicus*, Cuv.), in the outer development of its nasal organ, so surpasses all the monkeys and even all men that it has been set off as a distinct genus solely on account of this feature. It lives in the island of Borneo. The longitudinally furrowed, hook-shaped, flexible nose, impending over the mouth and an inch broad in the middle, is peculiar to the old male. Females and the young have instead of it only a small, depressed pug-nose. The tufted monkeys also deserve to be mentioned on account of their outward resemblance to the short-thumbed monkeys, which is given them by the long, rich hairi-

ness of the whole dark-gray body, even of the under side and the exposed surfaces of the hands and feet. On the head the hair is prolonged and erected in a peculiar way to form a long, stiff tuft, or rather mane, which extends down to the neck. Its habitat is in Farther India (Siam) and the larger Sunda Islands (Java and Sumatra).

The most prominent members of the group of South African short-thumbed apes is the guereza (*Colobus guereza*, Rüpp). This monkey is one of the most famous animals, and one of those which are most fully and imaginatively described in all special works and portrayed in plain and in fantastic styles; so that every owner of a natural history knows it by name, but nobody has seen it living. We do no wrong to truth when we say that the first guerezas which were seen living in the European public were the three specimens which were carried in a drosky in August, 1890, before our offices in the Berlin Zoölogical Gardens. A Greek had brought them from Massawah to Berlin, but our privilege of becoming acquainted with them is due chiefly to the disinterested intervention of Herr Menges, a much-traveled dealer and the director of the Somali exhibitions. I paid a considerable sum for them, and am not sorry for it, for, although none of these specimens is living now, they made students, artists, and friends of animals acquainted with one of the handsomest and most remarkable creatures known, and gave them opportunity to make the first correct pictures of it from life. The picture makes a more detailed description of the coloring of the guereza unnecessary; and I will only say that the way in which the white appears, as in a certain sense a border and trimming of the dark ground color, varies somewhat and might probably afford a means of distinguishing between the geographical varieties of a species that is distributed over the whole of interior Africa. Hans Meyer, the hardy conqueror of Africa's giant mountain Kilima Njaro, found in that region a form which he named *caudatus*, in which the whole tail is white; our specimens belong to a variety called *occidentalis* in Rocheprune's monograph on the short-thumbed monkeys. A considerable number of species of monkeys of western and central Africa are pictured and described in this special work; many of them, including the bear short-thumbed monkeys (*Colobus ursinus*, Waterh.), look much like a guereza without a side-mane; others, like the devil-monkey (*Colobus satanas*, Og.), are described as black; and still others are red. Of all these we know little except concerning the skins and the skulls, for they reach us living only exceptionally. I return to the guereza, the handsomest and most interesting species,

The trio of them which I got, all three young, perhaps half-grown fellows, were distinguished by something pretty and pleas-

ing in their behavior, and a similar account is given of them by those who have observed them in the wild state. The guereza

FIG. 3.—GUEREZA MONKEYS. (From a picture by W. Kuhnert.)

is not one of the hated field robbers, and it has therefore been hunted in Abyssinia only so much as is necessary to get material for the adornment of the small, round leather shields formerly in

use there. These shields have gone out of use since the style of armor has been changed, and it is now molested but little, and leads a peaceful life away from the dwellings of men. "In Gallaland, whence your specimens have come," Menges writes to me, "the guereza lives in the thick woods, especially in deep, moist, and warm mountain gorges. It prefers a home in the giant sycamore trees, or wild figs, the fruits of which constitute its principal food. The Abyssinian juniper, which is from twenty-five to thirty metres high, and forms whole forests there, is also much resorted to by it." Brehm, relying upon the unanimity of the accounts which have appeared since the discovery of the guereza by the Abyssinian traveler Rüppell, of Frankfort, enthusiastically praises the beauty, gracefulness, and elegance of the outward appearance of the animal and the agility and grace of its motions, especially its colossal leap, in which the body seems to be carried along by its waving robe. Hans Meyer unconsciously complements this sketch with a description of the quiet, still life of the societies of four or five members in the secure height of their tree-top, and in connection with it mentions a habit not to my knowledge observed before, by which the presence of a band of guerezas can be recognized from a distance. It is a monotonous, sing-song humming, with an alternating *crescendo* and *diminuendo*, proceeding from the members of the families sitting lazily together, and to all appearance expressive of complete satisfaction. Perhaps it was because of the absence of this satisfaction that I never heard this humming from my pets. They usually kept themselves quite still, and were accustomed only to greet their beloved greens with a peculiar cry toned between the whimper of the capuchin and the crowing of the young mandrill. With this we have come to the end of our observations on these two peculiar families of monkeys which have been crowded away into the background in our zoölogical gardens by their livelier, more striking, and more hardy congeners. But we hope that what we have said of their remarkable organization will be enough to make them seem worthy of some attention from the animal-loving reader.—*Translated for The Popular Science Monthly from Die Gartenlaube.*

One of the incentives that send explorers so often back to their work was described by Captain Younghusband after relating to the English Society of Arts the story of his experiences in the Pamirs. Like most travelers, he said, he had often thought he should not go again on such arduous adventures; but when the traveler returned to his native country, and saw that an interest was taken in what he had done, and that people would still be interested in further journeys he might make, he felt his energies renewed and was quite willing to undergo the hardships which must necessarily befall him, feeling that he was doing something for his government and his country.

"NEW" AND VARIABLE STARS.

By J. ELLARD GORE.

TO ordinary observation the light of the stars seems to be constant. Although of various degrees of brilliancy, the brightness of each individual star appears to most people to be invariable. This is, of course, true with reference to the great majority of the stars which deck our midnight sky. There are, however, many objects the light of which is subject to considerable fluctuations. These are known as variable stars, and form one of the most interesting classes of objects visible in the stellar heavens. Over two hundred are now known to be certainly variable in light, and many others have been suspected of inconstancy. In some of these stars the changes of brightness can only be detected by careful watching, but in many the light is variable to a considerable extent. In the variable star Chi Cygni, for example, the star's light at maximum is about sixteen hundred times the light at minimum. At its brightest it is sometimes fairly visible to the naked eye, whereas in its faintest phase a pretty good telescope is required to see it at all.

These most interesting and mysterious objects have been divided into different classes, according to the character of the light-variation and the length of the period which completes the cycle of their curious changes. The classification now generally adopted is that proposed by Prof. Pickering, of the Harvard Observatory, U. S. A. This includes five classes, which are as follows: 1. Temporary or "new stars"; 2. Stars with regular periods of considerable length; 3. Irregular variables, having no definite period; 4. Variables of short period—say, under thirty days; and, 5. Variables of the type of Algol, or those which, at regular intervals, undergo a sudden (or comparatively sudden) diminution of brightness lasting for a few hours only, the star remaining constant in light (or nearly so) during the remainder of its period. A short account of these different classes may prove of interest to the general reader.

1. "Temporary" or "new stars" are perhaps the rarest phenomena visible in the heavens. Comets—at least, those visible to the naked eye—are rare celestial visitors. *Telescopic* comets are, however, tolerably numerous, and scarcely a year passes without the discovery of several of these faint objects. Very few "new stars" have, however, been recorded in the annals of astronomical history. I refer, of course, to those which can properly be termed "new"—that is, stars the existence of which was previously unknown to astronomers, and which, blazing out suddenly, remained visible for a short time, and then faded away without again obtain-

ing a maximum of light. Considered from this point of view, these *novæ*, as they are termed, can not correctly, perhaps, be classed among the variable stars at all. They appear once only, and then die out, never to return; at least, no return of a true *nova* has yet been recorded.

A remarkable peculiarity about these temporary stars is their usually sudden appearance. In all the well-authenticated cases the stars have blazed out with startling rapidity. Such were the brilliant stars of 1572 and 1604; and in later years, those of 1866 in Corona Borealis, and of 1876 in Cygnus. Tycho Brahe's star of 1572 made its appearance near the star Kappa Cassiopeiæ, the faintest of the four stars forming the well-known square in Cassiopeia's Chair. It appears to have been first noticed by Cornelius Gemma, on November 9th of that year, and it seems to have blazed out very suddenly, as he states that it was not visible on the preceding evening in a clear sky. The attention of Tycho Brahe, whose name is generally associated with the star, seems to have been first attracted to it on November 11th. When first seen, it surpassed Jupiter and rivaled Venus in brightness, and was visible at noonday! At this brilliancy, however, it did not long remain, but gradually diminished in luster, and in March, 1574, had completely disappeared, at least to the naked eye. Its curious changes are thus described: "As it decreased in size, so it varied in color; at first its light was white and extremely bright; it then became yellowish, afterward of a ruddy color, and finished with a pale livid color." Tycho Brahe has left an elaborate record of his observations of this wonderful object in a work of no less than 478 pages of printed matter.

"Kepler's *nova*" of 1604 appeared in the constellation Ophiuchus in October of that year. The planets Mars, Jupiter, and Saturn were near each other in this region of the heavens, near Eta Ophiuchi, and one evening Brunowski, a pupil of Kepler's, remarked that a new and very brilliant star had joined the planetary group. When first seen the new star was white, and exceeded in brilliancy Mars and Jupiter, and was even thought to rival Venus in splendor. It gradually diminished, and in six months was not equal in brightness to Saturn. In March, 1606, it had disappeared. It was also observed by the famous Galileo. Kepler wrote a work on the subject, which is still preserved. Only faint stars are now visible with the telescope near the positions assigned to these bright stars of 1572 and 1604.

In 1670 a star of the third magnitude was observed by Anthelm near Beta Cygni. It remained visible for about two years, and increased and diminished several times before its final disappearance.

A small temporary star was observed by Dr. Hind in Ophiu-

chus on April 28, 1848. When first noticed it was about the fifth magnitude. It afterward rose to nearly the fourth magnitude, but gradually faded away. Hind was certain that up to April 3d or 5th no object of even the ninth magnitude was visible in the position of the new star. This curious object is still visible, but has become very faint in recent years. In 1866 it was of the twelfth magnitude, and in 1875 not above the thirteenth magnitude.

On May 28, 1860, a new star was discovered by the late Mr. Pogson in the globular cluster known as 80 Messier in Scorpio. When first seen it was about the seventh magnitude, and nearly blotted out the nebula by its superior light. On June 10th the star had nearly vanished, and the cluster again shone out with its usual brilliancy, and with a condensed center. Pogson observed the cluster on May 9th, and noticed nothing remarkable; and, according to Schönfeld, it presented its usual appearance on May 15th in the heliometer of the Königsberg Observatory.

The star of 1866, known as the "Blaze Star," suddenly appeared in Corona Borealis in May of that year. Although it was subsequently found that the object had been previously observed and registered as a small star by the famous German astronomer, Argelander, it presented at the time of its discovery all the characteristics of a true *nova*. It seems to have blazed out very suddenly, for at about 9.30 P. M. on the evening of the 12th of May in that year Prof. Schmidt, observing the constellation Corona Borealis at Athens, saw nothing peculiar. Indeed, he afterward expressed his conviction that at that hour a star of even the fifth magnitude could not possibly have existed near the position without immediately attracting his attention. Within three hours afterward—about midnight—it was discovered by the late Mr. Birmingham, at Tuam, Ireland, shining as a star of the second magnitude, and rivaling in brilliancy Alphecca, "the gem of the coronet." Its light, however, rapidly faded. On May 14th it was of the third magnitude; on May 19th, only of the sixth. On May 24th it had become invisible to the naked eye, and by June 9th had faded to the ninth magnitude. When near its greatest brightness its light was examined by Dr. Huggins with the spectroscope, which showed the bright lines of hydrogen gas in addition to the ordinary stellar spectrum. During the ten years following this extraordinary outburst of light, Schmidt observed fluctuations in its brightness, which appeared to take place with a certain regularity. It would therefore seem that this object should be considered as an irregular variable rather than a "temporary star." Its rejection from the list of "new stars" would remove the only exception to the rule that all these wonderful objects have appeared in or near the Milky Way. Even the new star which was ob-

served in August, 1885, in the great nebula in Andromeda forms no exception, for in Dr. Boeddicker's beautiful drawing of the galaxy, which has just been published, a faint extension of nebulous light is shown stretching from Cassiopeia's Chair to the nebula referred to.

A better example of a true temporary star is that which appeared in November, 1876, near Rho Cygni. It was first seen by Schmidt at Athens, soon after sunset, on the evening of November 24th, when it was about the third magnitude, and slightly brighter than Eta Pegasi. The appearance of this object was also probably sudden, for between November 1st and 20th Schmidt observed the vicinity, and was certain that no star of even the fifth magnitude could have escaped detection. Between November 20th and 24th the sky was, unfortunately, cloudy, so that the exact time of its appearance is unknown. This star was quite new, as it does not appear in any star-chart or catalogue. Like most of these curious objects, its light faded very rapidly. In the forty-eight hours following the night of November 27th it diminished to the extent of one and a half magnitude, and on November 30th it was reduced to the fifth magnitude. It afterward decreased with tolerable regularity, and in September, 1877, it was below the tenth magnitude. In subsequent years it became very faint. Ward found the star only sixteenth magnitude in October, 1881, and it was estimated of the fifteenth magnitude, at Mr. Wigglesworth's Observatory, in September, 1885. It was examined with the spectroscope a few days after its discovery, and its spectrum showed bright lines similar to the star in Corona Borealis. Subsequent observations seem to show that this extraordinary object changed into a small planetary nebula!

The star which appeared in August, 1885, in the great nebula in Andromeda (31 Messier) has been already referred to. It seems to have been independently noticed by several observers toward the end of August. It was, however, certainly seen by Mr. T. W. Ward, of Belfast, on August 19th, at 11 P. M., when he estimated it at nine and a half magnitude. On September 3d the star was observed at seven and a half magnitude, at Dunecht, by Lord Crawford and Dr. Copeland, and its spectrum was found to be "fairly continuous." The star gradually faded away, and on February 7, 1886, was estimated only sixteenth magnitude with the twenty-six-inch refractor of the Naval Observatory at Washington. Dr. Auwers has pointed out the similarity between this outburst and the star of 1860 in the cluster 80 Messier, and thinks it very probable that both phenomena were due to physical changes in the nebulæ in which they occurred.

The most recent example of a new star is one discovered by Mr. T. D. Anderson, of Edinburgh, in the last week of January

in the present year, and still visible with an opera-glass. It lies about two degrees south of the star Chi Aurigæ, in the Milky Way, and when first noticed was about magnitude four and a half. The star seems to have been visible for some time previously, as it has been found that its spectrum was photographed at Harvard Observatory, U. S. A., on December 1st, 10th, and 20th, before it was recognized as a new star. The actual time of its appearance therefore remains unknown, but that it is a new star there can be no doubt, as it does not appear in any star-chart or catalogue. The star is a very interesting object, and, according to observations by the present writer, is subject to sudden changes of brightness. It seems to be fading slowly, and on March 1st was still somewhat brighter than the sixth magnitude.* Its spectrum is a very remarkable one, showing, it is thought, both bright and dark lines. The line C and other lines in the red are visible, the D line of sodium and the series of hydrogen lines being also present. Most of the lines are said to be double, each consisting of a bright and dark component. These double lines suggest the presence of two bodies, or systems of bodies, one approaching the eye and the other receding from it, with a relative velocity of between five hundred and six hundred miles per second. There is a suspicion that the bright lines characteristic of nebular spectra are also visible. These remarkable results suggest that the light of this star, and probably that of all "temporary" stars, is due either to the rush of a solid body through a gaseous nebula, or the clashing together of two meteoric swarms moving in opposite directions. The phenomenon might also be explained by two bodies forming a binary star passing through their perihelion, the great increase of light being due to a "violent grazing collision" at the point of nearest approach. Whether this new star is a veritable *nova*, or "temporary star," or merely represents the maximum of a hitherto unrecognized variable star of long period, like the so-called "Nova Orionis," discovered by the present writer in December, 1885, must be left to time to decide. In either case, it is a most interesting object, and its future career will be followed by astronomers with great interest.

Coming now to Class 2, we find regular variable stars with periods ranging from about 100 to 700 days, and with fluctuations in their light from about one magnitude to over eight magnitudes. Among the most remarkable of these are Mira Ceti, or the "wonderful star"; Chi Cygni, already referred to; R. Hy-

* Further observations on March 10th and 11th showed that the star had then faded to below the seventh magnitude; and on March 16th I could no longer see it through an opera-glass.

dræ, R. Leonis, etc. Mira Ceti varies from about the second magnitude to a little below the ninth, with a mean period of about 331 days from maximum to maximum. Owing to its unusual brilliancy at maximum, and the great range of its light-fluctuations, this is perhaps the most interesting and remarkable of all the variable stars. The period of Chi Cygni is about 406 days, and its variation from about the fourth to nearly the thirteenth magnitude. R. Hydræ varies from the fourth to the eleventh mgnitude, with a period of about 437 days; and R. Leonis from about the fifth to the tenth magnitude, with a period of about 313 days. Most of the long-period variables are reddish in color, and show a banded spectrum, which seems to be a characteristic feature of this type of variable. Various theories have been proposed to account for the variation of light in long-period variables, but none of them are very satisfactory. The periodical outbreak of sun-spots on a large scale has been suggested, and also the clashing together of meteoric swarms revolving in an elongated orbit; but it must be confessed that the subject is still, to a great extent, a matter of mystery.

Class 3 includes the irregular variables—that is, stars which are undoubtedly variable, but have no regular periods. Sometimes these stars remain for long periods without any perceptible change, while at other times their fluctuations of light are very noticeable. Of these, perhaps the most remarkable are Mu Cephei (Sir William Herschel's "Garnet Star"), Alpha Herculis, Alpha Orionis (Betelgeuse), and Beta Pegasi. The variation is usually small, not exceeding one magnitude. Like the regular variables, these have also banded spectra.

In Class 4 are some very interesting objects—variable stars of short period. The greater number of these have periods of under eight days. The variation of light is generally small, but regular. In but few cases does it much exceed one magnitude, and in several it is less. In some, as in Beta Lyræ, Zeta Geminorum, and Eta Aquilæ, all the light-changes may be observed with the naked eye, while in others an opera-glass is necessary to follow the fluctuations.

In Class 5 are placed stars of the Algol type. These are the rarest of the regular variables, only ten having been hitherto detected. In these stars the light remains constant, or nearly so, for the greater portion of the period. A sudden diminution of brightness then commences, and all the light-changes are completed in the course of a few hours, after which the star returns to its normal brightness. The brightest of these remarkable stars are Algol (Beta Persei), Lambda Tauri, and Delta Libræ. The others are much fainter, only two being visible to the naked eye when at their normal brightness. A star of this class recently

discovered in the Southern Constellation (Antlia) has the surprisingly short period of only seven and three quarters hours—the most rapid variation hitherto detected in any variable star. All the Algol variables are white, or only slightly colored.

It was long since suggested that the periodical diminution of light in the Algol variables might possibly be due to the interposition of a dark, eclipsing satellite. Some few years since Prof. Pickering undertook a mathematical investigation of the case of Algol, and showed that an eclipsing satellite revolving in a nearly circular orbit in a period indicated by the light-variations of the star would satisfactorily explain the observed phenomenon within the limits of errors of observation, and he suggested that the orbit might be determined by spectroscopic observation of the star's light before and after the minimum. Observations of this kind made by Prof. Vogel at Potsdam, in 1888 and 1889, leave little doubt that the decrease of light is really due to an eclipsing satellite. He found that before the minimum the bright star is receding from the earth (and therefore the dark companion approaching), and after minimum it is approaching, thus proving the eclipse theory to be correct.

Herr J. Plassmann, of Warendorf, Germany, has lately announced his discovery of a secondary minimum in the light of Algol and Lambda Tauri. This, if confirmed, would seem to show that the eclipsing satellite is not absolutely dark, but possesses some inherent light of its own, this light being cut off when the satellite passes in its turn *behind* the disk of its primary.—*The Gentleman's Magazine.*

An extensive human settlement, belonging to the stone age, has been discovered near Schaffhausen, Switzerland, by Dr. Ruesch, and is being laid bare under his supervision. It is in a rocky niche, about thirteen metres high and thirty-seven metres long, and is the first of that period that has been discovered in Switzerland which is not connected with a cavern. The overhanging rocks offered a roof as protection against the weather. Quantities of flint knives, chisels, and lance-heads, bones of the reindeer, roe, stag, hare, cave-bear, and other animals, and human bones, needles, and the beginnings of drawings, were also found here.

A suggestion was made in Ciel et Terre, some time ago, that the date be regularly noted, as a climatological fact, of the day, for each place on which certain agricultural operations, particularly in harvesting, are begun. As the ripening of the crops depends on the absolute amount of heat they have received during the season, the date of beginning the harvest will determine when the amount of heat required by each plant has been accumulated. Father Cl. Buvé, curé of Linsmeau, Belgium, suggests that the measurement of the amount of beet-sugar produced from a given quantity of beets will serve the same end; for, other things being equal, it is entirely dependent on meteorological conditions.

THE WASTE AND GAIN OF THE DRY LAND.

THE following letter, respecting a former article in the Monthly, has been addressed to the Editor:

Editor Popular Science Monthly:

Does M. A. de L'Apparent's interesting address * on The Future of the Dry Land exhaust all the factors of the inquiry? Is it certain, for example, that some at least of the greatest mountain-chains have not in the main risen in elevation faster than the eroding agencies have depressed them? Are not some of them, and those now among the boldest, admitted to have been uplifted in comparatively recent times, geologically speaking—more recently, for example, than the advent of some of the rivers which intersect them? Erosion must have commenced from the very beginning of the upheaval and have continued to the present time; yet they grew in stature in spite of it, for no one now supposes that the upheaval was a sudden one. Indeed, the persistence of the river's "right of way" proves both the constant action of "the elements" and the extremely gradual character of the upheaval. If our planet, as some think, continues to slowly contract from a once nebulous condition, its advancing age might be expected to be marked by wrinkles, just as we know it to be.

Again, is there not good ground for the conjecture that our globe, however slowly, is approaching a state of desiccation such as is manifested partially in our neighbor Mars and still more notably in the moon? † Is there not some lingering continuance of the once active absorption? Is there not, for example, reason to believe that the proportion of sea area has in the main steadily diminished and that upheaval of the land masses has steadily increased since Silurian times?

To the lay reader this masterful and interesting paper of the French *savant* seems a courteous invitation to one of his compeers to take up the thread of his discourse at the point at which he elects to leave it.

GEORGE HENRY KNIGHT.

TEMPLE COURT, NEW YORK.

Other letters on this subject have been received, all of which indicate that the matter has attracted more interest than was anticipated. Our correspondents may find on closer examination of M. de L'Apparent's paper that he avowedly presents it as covering only one side of the question, and that, while he does not discuss

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* Popular Science Monthly, June, 1891.

† Do not northern Africa and western Asia contain vast regions that have passed from exuberant fertility to hopeless aridity even during the historical period?—G. H. K.

the compensating forces, he recognizes their existence and their title to be considered. If we understand him aright, his article was designed to be tentative, and as opening the way to a discussion in which much may be said on both sides.

The discussion which follows will help to give more light concerning M. de L'Apparent's views and meaning and their value.

M. Jacques Léotard has written in the Revue Scientifique that M. de L'Apparent has in his evidently very curious study arrived at his result only by neglecting several factors of contrary effect.

While it is admitted that the earth is swept by powerful atmospheric agents which, if their work was continued without compensatory action on the other side, would ultimately level and submerge all the continents, M. Léotard insists that there exist other very important causes of increase of the relief, the action of which now counterbalances and may ultimately surpass that of the solvent influences.

One of these causes, of which M. de L'Apparent took some notice, is the contribution of volcanic products to the soil It is one of the most minute of the factors, but M. de L'Apparent's estimate of one sixth of a cubic kilometre a year seems too small. The three hundred known active volcanoes on the surface of the earth ought to give out a much larger quantity of their internal products; and it should be remarked that the dejections of craters, besides lavas, comprise various rocks, mud, and ashes. But the importance of this factor, little at the most, is made still less by the occurrence of volcanic explosions on the sea-coast, in which considerable tracts of land have been swallowed up.

The chief essential cause of increase of dry land at the expense of the ocean lies in the evolution of our planet. During the geological epochs of thousands of centuries each the upheavals which formed existing continents have come in gradual succession, taking from the primitive sea, which originally extended over the whole earth, a larger and larger part of its immense domain. These upheavals, under the action of internal forces, have continued slowly till our own time in many regions, notably in the north and center of the Scandinavian Peninsula, Spitzbergen, northern Siberia, Turkistan, Scotland, Sardinia, Tunis, on the coasts of the Red Sea, etc., while the depressions of vast countries, which must not be confounded with little local collapses produced by the subterranean work of water, are less numerous. Besides the increase of continents, new islands of volcanic origin rise at times to the surface of the seas, and lands are also gradually formed by the accumulation of sedimentary matter and organic remains. The deltas which rise at the mouths of large rivers in consequence of the deposition of mud and sand transported by the streams, likewise constitute an augmentation

of the emerged soil, for the space they occupy is taken from the sea. The sea, moreover, does not eat away all the shores. There are coasts where the waves, instead of carrying away parcels of the dry land, operate to fill up the bays and to add to the littoral and prolong it in the direction of the sea. Thus the ocean every year deposits several million cubic metres of sand along the shores of the Gulf of Gascony.

Another accrement which has a right to be regarded as considerable is contributed by the legions of polyps constructing reefs and atolls of coral, to which is due the building up of whole archipelagoes in Oceania and the Indian seas. The islands formed by these minute zoöphytes are growing continually in extent and number, and are probably destined ultimately, by joining, to give rise to vast lands, real continents, which will gradually occupy the immense voids of the Pacific.

The shells of numerous species of animals and other remains of dead organisms, meteorites and cosmic dusts falling from celestial space, certainly produce further sensible augmentations of the continental mass.

Another essential cause of increase of dry land that might be added is the decrease of the ocean itself in consequence of infiltrations of water through the crust of the earth, which is a kind of porous mass, into which the liquid element percolates by innumerable fissures, taking possession of the depths and directing itself slowly toward the center, as the internal fire diminishes and the crusts crack open in consequence. It is understood that the activity of volcanoes and many earthquakes is largely due to this inevitable penetration of the water, which internal heat transforms into vapor under pressure. Some geologists think that the primitive ocean has already diminished in this way one fiftieth of its volume.

The water is all destined to disappear from the surface of the globe by being absorbed by the subterranean rocks, with which it will form chemical combinations. The heavenly spheres exhibit sufficiently striking examples of such an evolution. The planet Mars shows what will become of the earth in some thousands of centuries. Its seas are only shallow Mediterraneans of less surface than the continents, and these do not appear to be very high; and in the appearance of the moon, all cracked and dried up, we have a view of the final state of the earth—for the absorption of the water by the solid nucleus will be followed by that of the atmosphere.

We see, therefore, M. Léotard continues, that not only is there no equilibrium in the struggle between the oceans and the continents, but that, inversely to the conclusions of M. de L'Apparent, the event that may be considered very probable in a future repre-

sented by millions of years will be, not the disappearance of the dry land, but that of the sea, which, accompanied by all the fluids, will gradually infiltrate through the crust with which our planet is covered.

The certain feature in M. de L'Apparent's essay is that, before the eternal drought comes on, the terrestrial relief will be leveled. The continental surface will have become an immense plain, in which the Alps, Himalayas, and Andes will be only little hills. The fertility of the soil will be augmented by the considerable formation of vegetable earth, which will at the same time be deprived of sufficient watering by the rarity of rain. Climates, little as we may suppose them to be modified by the decrease of the luminous and calorific energy of the sun, will be entirely transformed. It seems to M. Léotard, in short, that the phenomena contributing to the destruction of the continents will diminish continuously in intensity, while the natural influences tending to result in the desiccation of the surface of the globe will gather energy in the course of ages, preparing for our planet the curious future just described—a future which will, however, be postponed so far that mankind will not be a witness of that end of terrestrial evolution.

Another writer in the Revue Scientifique (H. S.) has called attention to what the land is gaining, believing, in view of the universal stability of affairs, that it must be equal to the losses. The land gains everything, including cosmic dust and meteorites, that falls from space; it gains all the gases that are continually undergoing solidification in flesh and wood, with which they become incorporated; and it gains the shells of all the molluscs, infusoria, etc. With a very insignificant part of what these infinitely small beings have left it has been possible to build cities larger than Paris; and the Great Pyramid may be said to be the work, not of King Cheops, but of the nummulites. If a well-informed person should follow out all the facts bearing on the subject, he would probably find a complete equilibrium, an admirable compensation existing between the gains and the losses of the crust of the earth.

M. de L'Apparent has replied to M. Léotard's criticism that it rests on a misunderstanding which can be easily dissipated. In the summer of 1890, he says, "I discussed, in the Geological Society of France, the general question of erosion, not to predict the actual leveling down of the dry land, but simply to arrive at a method of estimating the duration of the geological periods. My reasoning was as follows: If the present causes of destruction (mechanical and chemical action of running waters and marine erosion) continue to act in the same measure as now, without anything intervening to disturb their working, the continental relief

will wholly disappear in four or five million years. Geology teaches us that the history of the crust of the earth embraces a period infinitely longer than this. That is enough to prove that another factor does intervene—that is, manifestations of internal energy, which disturb from time to time the acquired states of equilibrium, and restore a new force to the decreasing outer powers. Thus, instead of assuming a regular process of planing down, I laid down in principle that things would not go on in this way. A geologist, besides, could not reason otherwise, except he mistook the daily teachings of science which show him at every instant foldings and contortions of strata, certain signs of an order of things very different from the regular pursuit of external influences.

"Seeking, then, to place myself under the most unfavorable conditions for my theory, I supposed the ancient history of the globe divided into tranquil periods, each of four or five million years, separated from one another by so many ruptures of equilibrium. How many of these periods would be required to account for all the known sedimentary formations? In trying to solve this problem, I remarked that each period would have cast into the ocean a cube of *débris* which, scattered, according to Mr. J. Murray, through only one fifth of its area (the fraction over which, according to the soundings, the sedimentation of detritus extends), would form a bed of some six or seven hundred metres in mean thickness. It seemed to me reasonable to suppose that this thickness, null at the extreme further side of the deposits, would increase slowly at first, and then more rapidly toward the neighborhood of the coast, where it might attain a maximum of two kilometres. Dana having estimated at forty-five thousand metres the united depth of all the sedimentary formations when each is measured at its point of greatest thickness, I drew the conclusion that all geological history could be included within a time certainly less than ninety million years. After the publication of this note I was called upon by the general secretary of the Geographical Society to supply the place of a speaker who was unable to fulfill his engagement. I responded, undertaking to call the attention to the phenomena of erosion which I had been studying, without elaborating the purely geological considerations. I have recently presented an extended paper on these details to the Catholic International Scientific Congress, and in it have examined all the phases of the question. This paper will be published in full, and in it M. Léotard will be able to learn how greatly my views differ from those which he has mistakenly attributed to me.

"I will here only correct a grave error which my critic commits when he charges me with not having taken account of the accrement which volcanic action brings to the dry land. M. Léotard

forgets that all the lava that flows to the surface comes from the depths of the crust, where its departure leaves a void which can be compensated for only by the depression of the adjoining territory to such an extent that the emerged relief really gains nothing. More than this—volcanic action, which M. Léotard would make creative, is really, above everything else, destructive. I ask no better proof of this than the great explosions of which the nineteenth century has been the witness; that of 1845, at Temboro, which covered the neighboring country and the surface of the sea with a mass of *débris* estimated at a hundred cubic kilometres; and the more recent eruption at Krakatoa, which threw into the Strait of Sunda eighteen cubic kilometres of *débris* and formed an abyss between two and three hundred metres deep, in a place where there had previously stood a volcanic mountain several hundred metres high. While I have felt called upon to make this rectification, I will add that that does not prevent me from believing, with M. Léotard, that the final triumph of the dry land is infinitely more probable than its submersion; and that by reason of the considerable movements of the crust and the wrinkles which lateral compression in consequence of the progress of cooling can not fail to engender from time to time."

SKETCH OF LUIGI GALVANI.

THE experiments of Galvani were the beginning of a new course of development in physical science, the fruits of which promise to be infinite in number and of incalculable magnitude and importance.

LUIGI GALVANI was born in Bologna, Italy, September 9, 1737, and died in the same place, December 4, 1798. He exhibited when very young a fervent zeal for the Catholic religion, of which he was exact in observing the most minute rites. He even thought of going into a monastery, but was diverted from his intention, and, while his religious inclinations were still prominently marked, he became interested in scientific pursuits. Entering upon the study of medicine, he gave his attention chiefly to anatomy and physiology—human and comparative. Having successfully maintained a thesis on the Bones, their Nature and Formation, he was appointed, in 1762, public lecturer on anatomy at the University of Bologna, where he became known as a skillful and accurate teacher, though not eloquent in address. Along with his professorship he gained high repute as a surgeon and childbed doctor. He produced during the earlier period of his professional career a number of memoirs of considerable merit,

among the most important of which were those on the urinary organs and kidneys of birds and on the ears of birds. In the former paper he treated the subject with remarkable accuracy, showing the position of the kidneys of birds in the abdomen, their situation with respect to the vertebral column, and how they are adapted, as in quadrupeds, to the secretion of urine. The descriptions, all drawn with equal care, contained various curious facts, some of which had then the merit of novelty. Three years after this Galvani had prepared a large work embodying the fruits of his studies of the organ of hearing, when he was anticipated by the publication of Scarpa's Observations on the Fenestra Rotunda. He was astonished to find in this book the facts which he had announced at special sessions of the institute, and which he had believed to be his own exclusively, and, giving up the publication of the larger book, satisfied himself with imparting in a short sketch such facts as were not mentioned in Scarpa's treatise. He gave interesting details respecting the chord of the tympanum, the membranous labyrinth, the semicircular canals, and on the single little bone which in its own body and appendices performed the functions of the three little bones found in the ears of mammals. His most important work, the one on which his enduring fame is based, was published in 1791, under the title De Viribus Electricitatis in Motu Musculari Commentarius, or Commentary on the Forces of Electricity in Muscular Motion. It embodied, in a small volume of only fifty-five pages, the account of his experiments with the frog's leg, in which the kind of electrical manifestation to which Galvani's name is attached (galvanism) was first remarked by him.

Previous to the publication of this little book Galvani suffered his greatest grief by the death of his wife, Lucie Galeazzi, with whom he had lived happily for thirty years, and who, according to some of the versions of the story, had no little to do with his great discovery. This loss was followed by other troubles, which, although they did not so nearly touch his heart, were severe enough, and eventually perhaps hastened his death. The Cisalpine Republic required an oath from all persons in its service, which, it being repugnant to his political and religious convictions, Galvani refused to take. The Government deprived him of his position, and he, nearly reduced to poverty, went to live with his brother Giacomo. Soon afterward he fell into a decline, from which he could not be raised even by the skill and careful attention of the eminent physicians Uttini and Cingari. The Government of the republic, recognizing the eminent worth of his scientific achievements, notwithstanding he persisted in refusing to take the oath, ordered him restored to his chair in the university, but he never took advantage of the act.

Various stories are told of the manner in which Galvani's discovery of galvanic action, or "animal electricity," as he called it, was brought about. According to one version, he was preparing a frog-broth for his invalid wife, and some skinned frogs were lying on a table by the side of an electrical machine. One of his assistants accidentally touched the crural nerve of one of the frogs with the point of a scalpel, when all the muscles of the limbs seemed to be taken with strong spasms. Madame Galvani, a bright, thoughtful woman, who was present and witnessed the shock, was struck with the novelty of the phenomenon, and thought that she noticed along with it a disengagement of the electric spark. She informed her husband at once, and he lost no time in verifying the extraordinary fact. The point of the scalpel being again applied to the frog, while a spark was drawn from the machine, the contractions were resumed. To determine whether they were not due to the simple contact of the scalpel, Galvani touched the same nerves of other frogs without turning the machine, and got no contractions. Repetitions of the experiments were accompanied with corresponding results. Another account makes Galvani himself the chief actor in the incident; while, according to a third account, Galvani, having dissected some frogs, in a study of their nervous system, hung them on an iron railing with a copper hook thrust in their lumbar nerves, and the contractions took place whenever, in the vibration of the specimens, these nerves touched the iron too. According to the documents in the possession of the Museum of Bologna, the discovery was not all a matter of accident, as these stories would make it appear, for it is shown there that Galvani had been engaged, for twenty years before the publication of his Commentary, in investigations of the action of electricity on the muscles of frogs. The thought involved in these experiments had also been more or less vaguely suggested by other writers. Sulzer, in his Nouvelle Théorie du Plaisir, published in 1767, had spoken of the peculiar taste produced when two pieces of different metals were put, under certain precautions, into the mouth. A pupil of Cotugno, Professor of Medicine at Naples, in dissecting a mouse about 1786, perceived a movement at the moment when his scalpel touched one of the animal's nerves. Galvani described his experiments, and claimed that he had discovered a kind of electricity having remarkable peculiarities, in the Commentary (De Viribus Electricitatis in Motu Musculari) already mentioned, which was published in 1791 and 1792. One of the immediate results of his discovery was the invention of his metallic arc, the first experiment with which is described in the third part of the Commentary, with the date September 20, 1786. This arc was constructed of two different metals, which, placed in contact, one with a nerve and

the other with a muscle of a frog, caused contraction of the muscle.

Galvani recognized a great similarity between the phenomena he had observed and electricity, but denied their identity. He thought an electricity of a peculiar nature was concerned in the manifestations, and that he had discovered the nervous fluid. In his view, all animals possessed an electricity inherent in their economy, which resided especially in the nerves, and was communicated by them to the whole body. It was secreted by the brain; the interior substance of the nerves was endowed with a conducting power for this electricity, and facilitated its movement and its passage through the nerves; at the same time an oily coating of these organs prevented the dissipation of the fluid and facilitated its accumulation. The principal reservoirs of this electricity he supposed to be in the muscles, each fiber of them representing a small Leyden jar, from which the nerves were conductors. In the mechanism of the movements the electric fluid was drawn out and attracted from the interior of the muscles into the nerves in such a way that each discharge of the muscular electric jar corresponded with a contraction of the muscle. This theory had many partisans for a considerable time, but was refuted by Volta, who showed, as has been related in our recent sketch of him, that the supposed nervous fluid was only ordinary electricity, to which the animal organs served as conductors, and of which they might even be generators. Galvani did not yield to these arguments of Volta's, but held to his own unsound hypothesis; and thus the glory of making a scientific explanation and application of his great discovery fell to Volta. An account of Galvani's discoveries was published in the Philosophical Transactions for 1793. A quarto edition of his works was published at Bologna by the Academy of Sciences of the Institute of that city in 1841–'42. Perhaps the best and most appreciative accounts of Galvani's life and works are by M. Arago, in Alexandre Volta, in the first volume of Arago's Œuvres Complètes, and the eulogy by J. L. Alibert, Bologna, 1802.

Mr. A. Wilkins, of Tashkend, central Asia, had a specimen of the typical desert bird of the country (*Podoces panæri*), which, on the first day of its life with him, buried a part of the food given it in the sand with which the floor of the cage was covered. On the next day, and afterward, the bird abandoned the habit on perceiving that the supply given it did not fail. Another correspondent of Nature had a fox-terrier puppy, seven weeks old, which had not seen any other dog but its mother, that buried bones in the garden with great skill. It dug a hole with its fore paws, put in the bone, pushed it down with its nose, and covered it with garden soil which was pushed in with its nose. He had never seen so young a puppy bury bones, or any other dog do it so well.

CORRESPONDENCE.

GENESIS OF THE DIAMOND.

Editor Popular Science Monthly:

SIR: An excellent notice of Prof. A. E. Foote's paper on Diamonds in Meteorites has newly been forwarded to me, and, as it has apparently aroused no little interest in the general public as well as in scientific circles, may I take the liberty of calling attention to the following facts through the pages of The Popular Science Monthly, to which I have for some years past been a subscriber?

In September, 1886, my husband, the late Prof. H. Carvill Lewis, read before the Birmingham meeting of the British Association for the Advancement of Science a paper on A Diamantiferous Peridotite and the Genesis of the Diamond, a small specimen of which he had recently discovered, *in situ*, in a piece of the peridotite rock underlying the tenacious "blue clay" of the Kimberley mines. He further stated that this "blue clay" was found upon subsequent analysis to be merely the same peridotite rock in a high state of decomposition. The process of freeing the diamonds from the "blue clay," in which they are scattered about like plums in a pudding, is so well known that it need not be dwelt upon.

The peridotite in question is an altered lava, filling the neck of an ancient volcano, which burst its way through a rich deposit of carbonaceous shales. Numberless fragments of this shale, of varying size, were found scattered throughout the peridotite, and Prof. Lewis held that it was the pure carbon from these, which, liberated by the intense heat, and crystallizing slowly out under enormous pressure, had formed the diamonds.

In September, 1887, my husband delivered another address at the Manchester meeting of the British Association for the Advancement of Science, entitled The Matrix of the Diamond, in which he described in full the chemical changes and metamorphoses which the peridotite and its constituents had undergone in passing into the "blue clay." An abstract of this paper was distributed among the geologists present, and was afterward published in the Report of the Association for 1887.

At the close of this paper Prof. Lewis remarked that "if his hypothesis concerning the origin of diamonds was correct, they would certainly be found in meteorites"; but it was not until December of the same year (1887) that he received, through the courtesy of Mr. George Frederick Kunz, of New York, a small fragment of meteoric ore, in the larger portion of which two Russian geologists had newly reported the finding of several minute diamonds. Mr. Kunz found thirteen diamonds, I believe, in his share of the meteorite, and my husband found three; but in both cases all were microscopic. This discovery was soon after announced at the Academy of Natural Sciences in Philadelphia, and a short notice of it was published with the title Diamonds in Meteorites.

To Prof. A. E. Foote, therefore, belongs the honor of finding the first diamonds in American meteorites, and not of discovering that abstract possibility or its first realization.

The manuscript for a comprehensive article on The Origin and Matrix of the Diamond, embodying Prof. Carvill Lewis's Birmingham and Manchester addresses, and the subsequent investigations made by him as to the origin of that gem in the southeastern portion of the United States, is now in the hands of Prof. G. H. Williams, of the Johns Hopkins University, and will, it is hoped, soon be ready for the press.

In view of the foregoing statements, it seems open to question whether the position of the meteoric fragments on the side of an old volcanic crater was not an accidental one, which at all events calls for further investigation before those outside the charmed circle of scientific workers are willing to accept so remarkable a hypothesis as to the origin of our terrestrial diamonds.

I am, with respect,

Faithfully yours, JULIA F. LEWIS.

HEIDELBERG, *January* 29, 1892.

MORE ABOUT THE PENIKESE SCHOOL.

Editor Popular Science Monthly:

PRESIDENT JORDAN'S interesting article on Agassiz at Penikese forms a valuable contribution to the history of marine laboratories in this country, in giving a list, unfortunately incomplete, of those in attendance at the school during its first session. Might it not be possible to complete the list for both years during which the school was in existence? Such a list would form a valuable appendix to the interesting account of the school given by Mrs. Agassiz in her Life and Letters of Louis Agassiz.

President Jordan does not mention in his article the fact that the laboratory building no longer exists. It was destroyed by fire during last summer. A week before its destruction I visited Penikese with a small party from the Marine Biological Laboratory of Wood's Holl, Mass., and had the pleasure of meeting the present owner of the island, Mr. G. S. Horner, of New Bedford, who kindly gave us permission to carry away for the Ma-

rine Biological Laboratory anything we might find of interest or of use. We took advantage of this kind permission to detach from the walls the inscriptions which decorated the laboratory, and to which President Jordan refers. They were written on heavy paper and were in perfect preservation; they will hereafter adorn the walls of the linear descendant of the Penikese school—the Marine Biological Laboratory.

The inscriptions were not written upon the blackboard, as President Jordan states, on the authority of Prof. Eigenmann. This was occupied by some notes and drawings apparently used in illustration of a lecture on the vertebrata, said, I know not on what authority, to have been delivered by Prof. Wilder. The inscriptions themselves are not quite correctly quoted by President Jordan. They are as follows:

"Study Nature, not books."

"Learn to say, I do not know."

"A laboratory is to me a sanctuary, and I would have nothing done therein unworthy of the great Creator."

I quote these from memory, and am not quite sure as to the completeness of the second one, though what I have given contains the gist of it. It is advice which all young teachers, for whom it was primarily intended, should conscientiously heed.

Yours respectfully,

J. Playfair McMurrich.

University of Cincinnati, *April* 7, 1892.

FLOWERING HABIT OF THE AMERICAN ALOE.

Editor Popular Science Monthly.

Sir: In Grant Allen's very readable paper in the May issue—A Desert Fruit—mention is made of the American aloe (*Agave americana*) in a way to mislead as to its flowering habit. Permit me to say that the plant in question does not, as the writer says, "flower . . . once in some fifteen years or so"; *it flowers once only, and then dies.* In this city it is somewhat the exception for a summer to pass without one or more specimens of the agave throwing up an immense flower-stalk—not a spike but a *panicle*—to the height of twenty-five feet or more, with large clusters of flowers on the ends of its two- to six-foot branching pedicels; but, after the development of the flowers and ripening of the fruit, nothing remains of the previous tall rosette of fleshy leaves but a lot of withered and empty skins. And, by the way, the houseleek (*Sempervivum tectorum*), which takes several years to flower—five or six in these parts—has the same trick of dying as soon as it completes the process. It is doubtless on account of the habit which both these plants have, of multiplying by suckers or stolons, that many have overlooked their monocarpous nature, and have supposed that the new plants standing around were the same as flowered fifteen years ago.

George Pyburn.

Sacramento, Cal., *May* 1, 1892.

[We are glad to have the above particulars about the habit of the aloe, but we do not find in Mr. Allen's casual words any assertion that the same plant flowers more than once.—Editor.]

A CORRECTION.

Editor Popular Science Monthly:

Sir: On page 137 of your May number you inadvertently do a great injustice to Mr. Nicola Tesla, by styling him "the able lieutenant of Mr. Edison."

Mr. Tesla is an independent investigator, whose path has been the development of the alternating current, while Mr. Edison has followed the course of the direct current. I venture to suggest a note of correction.

Yours faithfully,

Charles Paine.

Century Club, New York, *April* 23, 1892.

EDITOR'S TABLE.

MOTHERHOOD.

MUCH advance has been made within the last generation in the matter of the education of women; but even the ambitious programmes of the present day do not make as full or as distinct provision as might be desired for instruction in the elementary duties and responsibilities of motherhood. We are very ready to allow that not every woman is called to be a mother, and we sympathize to a considerable extent with those who object to holding up marriage as the only goal at which women should aim. At the same time we incline very strongly to the opinion that the education of no woman can be complete unless it embraces the best obtainable knowledge as to how children should be brought up and trained, and as to the

qualities, physical and moral, which their proper nurture and culture demand of the mother. The woman who is not called to be a mother may be called to be an aunt, and as such may have a large share in the education of children. We are not all called upon to rescue or resuscitate drowned persons; but most of us would willingly possess the knowledge necessary for such a purpose. It may be said, Why teach the duties of motherhood more than those of fatherhood? If so, the answer is, We should teach them *more* because they are more comprehensive than those of fatherhood, and because the relation between mother and child is so much closer than between father and child. But we fully recognize the necessity for teaching the duties of fatherhood also; and, when moral culture receives due attention in our schools, the duties which a father owes to his children will not be overlooked.

Meanwhile, however, let us consider the other and more important question. Surely it would be a most suitable thing to impress upon every girl of proper age the sacredness of the maternal function. How impressively might we apply to the expectation either of fatherhood or of motherhood the words, "He that hath this hope purifieth himself." What stronger argument for purity of life could be urged than that derivable from the duty of giving sound and cleanly parentage to one's offspring? Why are so many marriages unhappy? Mainly because they are entered upon without any thought of duty or responsibility, or any sense of the restraints upon individual caprice and impulse which are essential to subsequent happiness. It would not be difficult to show in a forcible manner the actual misery which ignorance or disregard of physiological laws entails not alone on the offenders but on their progeny as well. Passing to the important question of the hygiene of the nursery, there is much that could be taught on sure grounds of science; and the subject, in the hands of a competent teacher, could hardly fail to prove most interesting. What more satisfying object can there be to a normally constituted woman than a healthy, well-conditioned, intelligent child? The result of due instruction in matters pertaining to a mother's duties would be to make the mothers of the future happier in their children and the children happier in their mothers. It is science, as we more and more see, that is chiefly required in the household. It is the lessons of experience that need to be gathered, collated, sifted, systematized, and brought home to the minds of both fathers and mothers. We constantly hear of young couples who start off with theories of their own on the subject of the treatment of children, just as if there were no established principles available for their guidance. Surely this is folly: the very last matter to which wild experimentation should be applied is the bringing up of children; and we pity most sincerely the children whose parents think that it has been left for them to originate the true principles of child-education.

That thousands of children suffer from the over-indulgence of their parents and thousands more from their over-severity, does not admit of dispute. In any course of instruction such as we have hinted at a considerable place should be given to the psychology of the child, and a considerable place also to the commoner defects of parents. It is a wise mother that does not unduly stimulate the self-consciousness of her child, and thus lay the foundation for life-long habits of affectation. If clever children do not always make clever men and women, a partial reason may be found in the way they are commonly treated. They find grown-up people constantly on the watch to hear, and most industrious in repeating, their original speeches; and soon they exchange the gift of originality which consists in seeing and expressing things in an uncon-

ventional manner, for the very inferior one of making smart speeches. They are thus forced by the very admiration of their elders into taking conventional instead of unconventional views, and speaking, as it were, to the "gallery" instead of uttering spontaneous truths. Thus—

"Shades of the prison-house begin to close
Upon the growing boy"

or girl altogether too soon. The way to promote originality is to leave the mind as long as possible in direct and living contact with things, and, to do that, it is necessary to avoid any great appearance of interest in or astonishment at the judgments the child forms or the phrases it uses. As soon as a child begins to find its own *opinions* interesting, instead of, as before, finding *things* interesting, farewell to originality! Will any one say that, if girls were taught how the minds of children might be kept fresh, they would not value the knowledge and, when the time came, try to turn it to account? We hardly think so.

Too vigorous denunciation could scarcely be bestowed upon the fashion so many mothers have of making their children mere instruments of their own vanity. Most mothers, we imagine, even in this advanced age, regard their children as gifts from Heaven; but do they suppose that Heaven gave them children that they might turn them into preposterous human dolls, and prematurely age them with the burden of social follies? Here we see the need of a strong appeal to the mother-instinct of those who are not yet mothers, that they may be led to conceive a horror of sacrificing innocent children to the Moloch of an artificial and heartless society. What do we want—manikins, puppets, little bedizened and bemannered creatures full of social spites and rivalries, or children full of healthy impulses, pure, truthful, and loving, of whom it might conceivably be said that "of such is the kingdom of heaven"? Alas, that so many should deliberately choose the former, and these not the less but the more religiously devout members of the community!

One point on which a judicious teacher, addressing girls on the duties of motherhood, would certainly utter a caution, would be as to allowing the mere maternal instinct to run to excess and pass beyond control. The maternal instinct must be considered as having for its object the good of the child; but, like all instincts and passions, it tends to become an object to itself, and then the interest which it is meant to subserve suffers; the child is worried and hampered by the over-abundance of maternal caresses and attentions, to the injury sometimes of its regard for the mother. We are well aware that a perfectly balanced human being is more than the most careful education can be expected to produce; but that is no reason why we should not aim at a desirable and possible balance of faculties—of reason and imagination, of thoughts and emotions, of judgments and impulses. A woman who is all mother does not make the best kind of mother. Cases are not wanting in which an unrestrained excess of the maternal instinct injures the relation between husband and wife and mars the harmony of the household. All this could be illustrated by numerous and varied examples; and this is the kind of knowledge which we maintain might with great advantage be imparted to the rising generation of girls. Why should human happiness be wrecked for want of knowledge which so many could supply from their own experience, and of scientific principles which are the commonplaces of all who think? The time has surely come when motherhood should be redeemed from the automatism of blind instinct and wedded, for its own high purposes, with the force of intellect. We shall be happy if these few words should incite to thought on this most important subject, and cause attention to be paid to it in quarters where, as yet, it has been neglected.

LITERARY NOTICES.

THE DISCOVERY OF AMERICA. By JOHN FISKE. Cambridge: Houghton, Mifflin & Co. 1892. In two volumes.

PROF. FISKE opens his subject with a discussion of the question of the grade of culture reached by the inhabitants of the American continent at the time of the discovery. The gorgeous accounts given by the Spaniards of the civilization of Mexico and Peru have survived until quite recent times, not only in the popular imagination, but in the writings of sober-minded authors. Careful research has, however, dissipated these earlier conceptions of American culture and put it in the right relation to the condition of advancement reached by the Old World peoples. Prof. Fiske gives the chief credit to the clearing up of this question to the late Lewis Morgan, whose generalizations he in the main accepts. According to Mr. Morgan's classification, the three well-marked stages in culture are savagery, barbarism, and civilization, the dividing line between the first two being the invention of pottery, and that between barbarism and civilization the invention of the alphabet.

According to this classification, none of the American peoples at the time of the voyage of Columbus had reached a higher stage of culture than the middle status of barbarism. In the Old World this stage of culture was marked by the domestication of animals other than the dog, but nowhere in America outside of Peru were there any domesticated animals except the dog, and in the latter those of the Old World were unknown. The social development reached by the aboriginal American was in keeping with that in the arts. The Spaniards, with their notions of society derived from mediæval Europe, naturally interpreted the social arrangements they found in terms of their experience, but nowhere on the American continent, save in Peru, was there anything approaching a nation. The organization of the Aztecs in Mexico was similar to that of the more advanced Indians to the north—viz., that of the clan. Montezuma, whom the Spaniards mistook for a king, was simply the chief of the clan. The living was communal in structures the property of the clan, and there was no development of the idea of private property except in things purely personal. Peru had passed beyond this stage, and had acquired the position of a rudimentary empire, but in some things was less advanced than Mexico. Neither country had yet acquired the art of smelting iron, and between both and the beginnings of civilization there lay the vast tract which terminates with the invention of the phonetic alphabet.

Prof. Fiske follows his survey of the inhabitants of the American continent by a discussion of the visits of the Northmen to the American coast, and then takes up the relations of Europe with the East, which completes his survey of the subject, preliminary to the memorable voyage of Columbus. In his chapter on pre-Columbian voyages he sums up what is known of the voyages of the Northmen. Far from being mythical, these voyages were very real. These northern seamen settled Iceland, and from there spread over to Greenland, where two settlements were made which lasted for four hundred years. From these settlements voyages were made down the American coast as far south probably as Massachusetts. An attempt was made to found a settlement in Vinland, which was the name they gave to a part of the coast visited, but this came to no result, and they did nothing beyond visiting the place to cut timber. None of these voyages did anything toward altering the relations of the Eastern and Western world. The two streams of life flowed on as they had for centuries, unknown to each other. It was not until the epoch-making voyage of Columbus and those who followed after that the two worlds were brought into contact. Prof. Fiske, therefore, rightly considers that the voyages of the Northmen were in no sense anticipations of Columbus.

In order to understand the meaning of the voyage of Columbus, we must understand the economical condition of the Europe of the fifteenth century and its relation to the East—or Cathay, as it was termed. We must also, as Prof. Fiske insists, banish from our minds the modern map, and try to put ourselves in the place of the people of that time. A rich trade had for some centuries been carried on between Europe and the East, in spices, gums, and fine fabrics. Genoa and Venice were rival centers of this trade, and had each overland routes to the

fabled land of the East. The traders did not actually pass from Europe to India and China, but met the Eastern traders and made exchange of products. Their knowledge of the East was therefore mostly hearsay knowledge, and, as is generally the fact in such a case, much fable was mixed with the truth. It was not until the middle of the thirteenth century that it became known in Europe that there was an ocean to the east of Cathay, and it was not until the close of the century, when Marco Polo published an account of his long sojourn in the East, that there was any definite information of these far-off countries accessible to Europeans. This Eastern trade, which had been steadily growing, had reached large proportions by the middle of the fifteenth century. But just at this juncture political events occurred which threatened its destruction by cutting off the routes heretofore used. The overthrow of the Mongols and the coming in of the native Ming dynasty in China had resulted in the exclusion of foreigners from that country. The rise of the Ottoman Empire and the conquest of Constantinople had cut off the northern route used by Genoa, and the Venetian route by way of Egypt was threatened by the same power. Men's minds, therefore, turned with ardor to the question of finding an outside route to the Indies. The significance of an ocean to the east of China began to be apprehended, and by the time of the first voyage of Columbus the European mind was ripe for projects for the finding of a water route to the Indies. Very little faith, however, was put in any scheme to find the Indies by sailing west. The hope and expectation were all in the direction of finding a route down the west coast of Africa and then east. No one had any idea of the extent of Africa, and, though many voyages were undertaken by Portugal, it was not until after the voyage of Columbus that Africa was entirely circumnavigated and an easterly route to the Indies discovered.

Prof. Fiske details very fully the struggles of Columbus to interest, first Portugal and then Spain, in his project of finding the Indies by sailing westward. The only ground upon which such an expedition could be based was the one that it would furnish a shorter route to the Indies than that which Portugal was seeking—down the west coast of Africa. Columbus calculated that the distance from the Canaries to Japan, the wonderful island kingdom to the east of Cathay, could not be much more than twenty-five hundred miles. As Prof. Fiske points out, this was a case where a little knowledge was helpful instead of dangerous. The perils of the voyage seemed great enough with this estimate of the distance; they would have been prohibitory had the real distance to Asia been known. Columbus died in the belief that he had reached land just off the Asiatic coast. He did not dream that he had landed upon a new world separated from Asia by a vast ocean. Years were to elapse before this fact should be appreciated by Europe, and the labors of many able navigators, extending through a period of two hundred years, were necessary to completely map out the vast new continent to which Columbus led the way.

Prof. Fiske, in recounting the many voyages and explorations by which the New World was brought within the domain of accurate knowledge, is very successful in grouping them so as to preserve the historical perspective. The reader appreciates the gradual growth of knowledge in Europe as successive voyages furnish new data, until at last there is the rounded out and completed whole. The text is supplemented by maps made from time to time by European cartographers, which are more vividly illustrative of the state of European ignorance than any amount of description could be.

Prof. Fiske devotes considerable space to clearing up the obscurity that surrounds the naming of the New World America. From this it appears that this name was proposed by a German cartographer for the land discovered by Americus Vespucius on his third voyage, when he was blown westward to the extreme eastern coast of South America. It was not known until long afterward that this land had any connection with that discovered by Columbus. The latter was supposed to be Asia, and the place occupied by the land visited by Americus was supposed to be open sea. It was therefore felt to be a proper thing to give to this new land, which was not Asia, the name of its discoverer. Later, when it became known that this was part of a land of continental dimensions, which extended far to the north as

well as to the south, the name had become so fixed that it was applied to the entire continent.

The conquests of Mexico and Peru are given a large share of attention, and a very vivid and interesting picture is drawn by Prof. Fiske of these first considerable conflicts between the two orders of culture of the Eastern and the Western worlds.

The author closes his account of the discovery with the story of the navigators and explorers who, for two centuries after Columbus, were busy with the detailed exploration of the great American continent.

To those familiar with Prof. Fiske's writings, it is needless to say that the work is thoroughly well done. It is drawn from original sources, and, while here and there points remain to be cleared up, we have in the present volumes in graphic and vivid form the story of the great chain of events, in their true historic proportions, which won for civilization a New World.

NATURAL SCIENCE. Monthly. London and New York: Macmillan & Co. Price, one shilling a number.

WE have the pleasure of welcoming a new scientific magazine, the first number of which appeared in England in March. It is to be primarily a record of new observations and discoveries in the field of natural history adapted to the needs of amateur investigators. "It will be our constant aim," say its conductors, "to expound and deal in a critical manner with the principal results of current research in geology and biology that appear to be of more than limited application. Original articles referring to the existing status of certain special branches of natural science, with suggestions for further development, will be a prominent feature. Periodical summaries of the latest results in the various departments are contemplated. Reviews of the more important new books will be not merely critical but also descriptive. Special attention will be given to the latest news concerning the work of all the principal societies and institutions throughout the world devoted to scientific and educational matters."

The magazine will have also a polemic tendency, for it starts with the avowed purpose of combating professionalism. "Half a century ago," it says, "scientific research was almost entirely in the hands of amateurs —independent workers, as Humboldt, Darwin, Lyell, Murchison, Hugh Miller, Waterton, and others." But a change has been wrought, mainly by the very rapidity of scientific progress. The more rigorous requirements of scientific work in recent years have operated to discourage amateurs, and hence to produce a wide gap between the scientific workers and the general public. Both science and the public have suffered in consequence; hence it is to be one of the aims of the new magazine to promote a better state of affairs.

The first number opens with a few pages of Notes and Comments, which are followed by articles dealing with Some Recent Observations upon Mimicry, by Frank E. Beddard; Deep-sea Deposits, by J. J. H. Teall (being a review of the Report on the Challenger Specimens, by John Murray and A. F. Renard); The Evolution of Fins, by A. Smith Woodward, illustrated; Some Salient Points in the Study of Mammals during 1891, by R. Lydekker, illustrated; English Lake Dwellings, by James W. Davis; Marine Snakes, by G. A. Boulenger, illustrated; The Exploration of Coral Reefs by Borings, by J. W. Gregory; Some Recent Researches on Insects and Arachnids, by G. H. Carpenter; Relationship of Sigillaria and Stigmaria, by Thomas Hick; and The Mammals of India, by R. Lydekker, illustrated. There are also review, news, and obituary departments.

THE PHILOSOPHICAL REVIEW. Bimonthly. Edited by J. G. SCHURMAN. Boston: Ginn & Co. $3 a year.

CULTIVATORS of philosophy have now the promise of a well-conducted and regularly appearing magazine devoted to metaphysics and the allied subjects—psychology, logic, and æsthetics. Its prospectus announces that the review "will be an open forum alike for those who increase the stock of positive data and for those who strive to see new facts in their bearings and relations, and to trace them up to their ultimate speculative implications. An equal hearing will be given to both sides of every unsettled question. The attitude of the review is non-partisan. Writers alone will be responsible for their articles, which in all cases must be

signed." The initial number of this review opens with a paper on The Critical Philosophy and Idealism, by Prof. John Watson, of Queen's University, taking Caird's work on Kant as a starting-point. Prof. George T. Ladd follows with a review of James's Principles of Psychology, under the title Psychology as So-called "Natural Science"; and Benjamin I. Gilman contributes the first part of an essay on Psychological Aspects of the Chinese Musical System, with extended examples. There is a carefully edited department of Reviews of Books, and another department in which are given summaries of articles on philosophical topics in other periodicals.

THE JOURNAL OF COMPARATIVE NEUROLOGY. Quarterly. Edited by Prof. C. L. HERRICK. Cincinnati: Robert Clarke & Co. $3 a year.

PROF. HERRICK has undertaken the publication of a periodical which shall make known the results of researches upon the nervous systems of man and the lower animals. The two numbers now before us contain contributions to the Comparative Morphology of the Central Nervous System, by the editor, and Morphology of the Avian Brain, by C. H. Turner, both papers being continued, accompanied by plates. There is also a contribution dealing with Recent Investigations on the Structure and Relations of the Optic Thalami, by Henry R. Pemberton. The other matter in the numbers consists of notes on laboratory technique, editorials, and literary notices. In addition to the physiological topics treated in the journal, the editor intends to give increasing attention to the problems of comparative psychology.

A GUIDE TO ELECTRIC LIGHTING. By S. R. BOTTONE. London and New York: Macmillan & Co., 1892. Pp. 189. Price, 75 cents.

THIS little manual essays to give in concise form the information necessary to acquaint the non-scientific reader with the principles of electric lighting. The author first treats of the electric battery, and then of the dynamo as a source of the electric current, and explains the meaning of series and multiple arc distribution. A chapter is given to lamps, arc, incandescent, and the now obsolete form known as semi-incandescent, or incandescence in the open air. In the arc lamps figured and described the only one in extensive commercial use is the Brush, of which there is a diagrammatic sketch. As the book is designed as a guide to householders and amateurs, and is not meant to be historical, the description of apparatus that have ceased to have a commercial place does not seem to be called for, and only serves to confuse the reader by presenting a multiplicity of appliances. This remark applies as well to the storage battery as to obsolete forms of lamp. Whatever the possibilities of the storage battery for power uses, it has no place in electric lighting, and there is but little probability that it ever will have. A chapter is devoted to fittings, in which is included a brief description of voltmeters and ammeters, and also one to the electric motor. Mr. Bottone seems to have but little conception of the predominating position which is being taken by alternating-current distribution, to which he gives but a couple of pages, which contain little information. The subject of meters is treated very cursorily. This would seem to be a subject of especial interest to the consumer, and a full description of the principles involved and somewhat detailed descriptions of the meters actually employed in commercial work might properly find a place in a book of this kind.

Of the volume as a whole very little can be said in commendation. It is too brief to be of much use to one wholly unacquainted with the subject, and the salient features which would be of importance and interest to the householder are not brought out with sufficient clearness. The book is printed on good paper, in clear type, but the cuts, with a few exceptions, are wretched.

THE THREE CIRCUITS. A Study of the Primary Forces. By TAYLOR FLICK. Published by the author. Washington, D. C., 1892. Pp. 268. Price, $1.50.

THIS is one of those pseudo-contributions to science which make their appearance once in a while, written by men who, without any thorough grasp of the fundamental conceptions of modern physics, undertake to remodel our views of molecular and planetary forces. The domain of elemental forces is sufficiently vague and obscure to give scope to attempts of this character, and not a few

essays have therefore been made into it by men ill fitted to add anything of a useful character to our current conceptions.

The author's thesis is that all worlds as well as the ultimate particles of matter are magnets, and that the planetary and stellar motions are the expressions of magnetic attractions and repulsions. According to his idea, light and heat are not transmitted from the sun, but are formed in our atmosphere by the interaction of magnetic forces. The author has some good ideas, and in some things he is in line with the most advanced views of modern physics, but what is good is so mixed up with a lot of insufferable rubbish that it is nearly if not quite impossible to disentangle the two. The book as a serious philosophical work is greatly marred by the flippant style of treatment and the introduction of a hypothetical personage from whom the author derives the views he offers.

UNIVERSITY EXTENSION. A Monthly Journal devoted to the Interests of Popular Education. Philadelphia: J. Haseltine Shinn. $1.50 a year.

THE first number of this magazine appeared in July, 1891, and already, before its first volume is complete, its circulation has become so large as to warrant a reduction to half the original subscription price. The contents of the numbers so far issued consist of outlines and suggestions for carrying on the new and popular form of educational work to which the magazine is devoted, with accounts of what has been done at the various centers for this work. In the number for April are articles on Class Work in University Extension, Extension Teaching in Wisconsin, University Extension Work in Mathematics, and An Unknown Quantity and One Possible Value. The last article advocates an extension of our free high-school system by means of evening sessions, so as to bridge the gap between the elementary schools and the university-extension work. The magazine is conducted by the American Society for the Extension of University Teaching, in Philadelphia.

G. Masson, of Paris, has begun the publication of the *Encyclopédie Scientifique des Aide-mémoire*, or Memory-help Scientific Encyclopædia, the volumes of which are prepared under the direction of M. H. Leauté, member of the Institute of France. While the publication is expected to be marked by a practical character, it will at the same time be truly scientific. It will be composed of eight hundred volumes in small octavo, which are expected to cover the entire domain of the applied sciences. Each of the volumes will be by an author who is an authority, and will give in a condensed form the precise present condition of science on its special subject and of the practical conditions relating to it. The eight volumes which were to have appeared on the first of April include works on Chronic Delirium, by Dr. Magnan; Gynæcology, by M. A. Auvard; Transmission of Force by Compressed or Rarefied Air, by M. Al. Gouilly; A Calorimetric Study of the Steam-Engine, by M. V. Dwelshauvers Dery; Disease of the Respiratory Organs, by Dr. Faisans; Electrophysiology, by Dr. G. Weiss; Distribution of Electricity by Isolated Installations, by M. R. V. Picou; and Resistance of Materials, by M. Duquesnay.

A book by *Julian Ralph*, entitled *Along the Bowstring*, is a guide-book to the south shore of Lake Superior. The Bowstring which gives it its name is the Duluth, South Shore and Atlantic Railroad, which runs (on the map) in a marvelously exact straight line from Sault St. Marie to Duluth. Special descriptions are given of Marquette and Presque Isle and of Mackinaw; and Dr. M. E. Wadsworth contributes an interesting scientific chapter on the Geology of the Marquette and Keweenan Districts. Published by the Duluth, South Shore and Atlantic Railroad.

How to reduce your Weight, or Increase it, a vivacious monograph by Celia Logan, chatty and personal while intended also to be practical, is defined as "an exposition of the Salisbury plan." Its purpose, as outlined by the author, is to make plain to every one how an easy and sure deliverance from the burden of corpulence is in his own hands; and, incidentally, to point qut a way by which the meager may, readily and agreeably, attain a pleasing roundness of outline. The author professes herself to have used her prescription with advantage. William A. Kellogg, publisher, 1023 Sixth Avenue, New York. Price, 50 cents.

Notes on Beauty, Vigor, and Development, published by Fowler & Wells Co., is a

booklet of practical directions for acquiring plumpness of form, strength of limb, and beauty of complexion, with rules for diet and bathing, and a series of improved physical exercises, based on the text of William Milo, of London. It gives much sound and interesting hygienic lore for ten cents.

The *President's Annual Report of Columbia College for 1891* presents a record of a very full year of changes and progress incident to a lively growth. The College of Physicians and Surgeons, which has been affiliated since 1860, is now fully consolidated as a part of the institution. An important addition to the faculty is the institution of the Da Costa Professorship of Biology, with Prof. H. F. Osborn as its incumbent, and Dr. Bashford Dean as instructor. Prof. Osborn has been appointed Curator of Mammalian Paleontology in the American Museum of Natural History, and the first important step has been taken toward co-operation of that institution and the college. Another movement in the direction of co-operation has been made in the arrangement with the Union Theological Seminary for interchange of privileges. The Law School has been reorganized, with a new course of three years, and a new chair of International Law and Diplomacy. The Department of English has also been reorganized, and a Department of Literature created, with Mr. George E. Woodberry as professor. The faculty of philosophy, philology, and letters has been further strengthened by the creation of the chair of Experimental Psychology, with Prof. J. McK. Cattell as professor. Other changes, rather incidental than fundamental, are noticed in the report.

The *Ninth Annual Report of the Massachusetts Agricultural Experiment Station* represents that a favorable season has aided materially in a successful termination of a variety of field experiments as well as in a satisfactory general management of the farm-work. The introduction of a vegetation-house for the purpose of studying, under well-defined circumstances, the influence of special articles of plant-food on the growth and character of plants and other intricate questions of vegetable physiology, is mentioned as an important addition to the resources of the institution. The report embodies detailed accounts of feeding experiments, field experiments and observations in vegetable physiology and pathology, special work in the chemical laboratory, and meteorological observations.

The work of the *Connecticut* Experiment Station, as presented in its report, has included analyses of commercial fertilizers; testing samples of butter, oleomargarine, molasses, and vinegar; analyses of feeding stuffs; various tests and analyses of milk, cream, etc.; experiments on the continuous growth of Indian corn on the same land; tests of the relative yield, in the course of years, of potatoes from tubers of different sizes; studies of the albuminoids or proteids of the seeds of the oat, flax, and cotton; and experiments, chemical and other, on the curing of tobacco.

The *Indiana* Experiment Station has suffered some changes in the personality of its staff, but its efficiency has not been impaired thereby. A study has been made for several years bearing upon the suitability of Indiana as a sugar-beet producing State, with encouraging results under certain conditions and in certain parts of the State. Investigations are in progress on the application of nitrogenous fertilizers to wheat. The plant diseases of grain, smut, a bacterial affection of the sugar-beet, and maladies of carnations have been studied. The lumpy jaw of cattle is under investigation. The feeding experiments relate to the influence of the physical condition of the rough food on meat production in steers; comparative rations of whole and skim milk for calves; different forms of feeding corn, and rations designed for producing lean or fat meat in pigs.

The *Nebraska* experiment station is gradually becoming recognized as an important factor in the agriculture of the State. The number of farmers who turn to the office for information is rapidly increasing; and the demand for the bulletins, which go regularly into the hands of more than five thousand actual farmers, is very great. The bright promise of the beet-sugar industry has led to giving it prominence in the shaping of investigations and in the report. Besides accounts of field experiments and meteorological observations, the report also contains a catalogue of the native trees and shrubs of Nebraska and "farm-notes" on many subjects.

The report of *S. A. Forbes*, State Ento-

mologist of Illinois, *On the Noxious and Beneficial Insects of the State for 1889 and 1890*, mentions as among the most noteworthy events of the entomological record the almost complete disappearance of the worst outbreak known of the chinch-bug, the very destructive development of the grain-louse, and the appearance of the European fruit-bark beetle, which is injurious to stone fruits. Besides these insects the report contains papers on experiments with arsenical poisonings, the American plum-borer, the common white grubs, the Hessian fly, the corn-root aphis, and diseases of the larger corn-root worm and the chinch-bug. An appendix to the report comprises an analytical list of the entomological writings of William Le Barron, second State Entomologist of Illinois.

Good Roads is a new illustrated monthly magazine devoted to the improvement of the public roads and streets, edited by *Isaac B. Potter*, and published by the League Roads Improvement Bureau. Its general aim will be to stimulate the interest of the public concerning the advantages of good roads and streets, and the best methods of constructing and maintaining them; and it is intended to make the magazine of interest and value to every person who travels the common roads. It will give news of all events bearing on the improvement of roads, and a series of articles on leading subjects pertaining to it. The four numbers of the journal before us conform to the standard set up in announcing these purposes.

An account of *The Fourth International Prison Congress* has been prepared by the Hon. C. D. Randall, at the request of the Commissioner of Education, at whose office it is published, in Washington. Besides the proceedings and addresses at the Congress last held, a summary of the proceedings and results of the three previous International Congresses is presented. In the appendix are further given an account of the entertainments and excursions tendered to the Congress, papers with reference to John Howard, an abstract of a conference of the managers of the reformatory and industrial institutions of Great Britain, and information concerning Russian and Siberian prisons.

"Brochure" 2, Volume I, of the *Proceedings of the Rochester Academy of Science* contains a variety of papers, among which are botanical, geological, and zoölogical section reports; special geological and archæological articles; a list of the indigenous ferns in the vicinity of Rochester; notes on aboriginal implements recently found in Irondequoit; Peru, its people, productions, and physical characteristics; the Grand Cañon of the Colorado; the Economic Minerals of the Ancients; Cetaceans, etc.

The American Journal of Morphology, Volume V, No. 3, C. O. Whitman and E. P. Allis editors, contains papers on the Osteology of Mesohippus and Leptomeryx, with Observations on the Modes and Factors of Evolution in the Mammalia, by W. B. Scott; The Growth and Metamorphosis of Tornaria, by T. H. Morgan; A Human Embryo Twenty-six Days Old, by F. Mall; On the Precocious Segregation of the Sex Cells in Micrometrus Aggregatus, Gibbons, by Carl H. Eigenmann; Some Points in the Development of the Toad-Fish (Batrachus Tau), by Cornelia M. Clapp; Development of the Epiphysis in Coregonus Albus, by Charles Hill; and Notes on the Development of some Sponges, by Henry V. Wilson. Boston: Ginn & Co.

Le Poil des Animaux et les Fourrures (The Hair of Animals and Furs) is a pendant to a work by the same author, Lacroix-Danliard, on the feathers of birds. In it the structure, form, and color of hair are considered; hairs are classified according to their origin and consistence, and uses to which they are applied, as fine hairs and downy fur; hairs that are spun, woven, carded, or combed; felting and hats; and silks, horse-hairs, and their uses in brush-making and upholstery. Further, the author describes the habitation, ways, and hunting of the animals which furnish the raw material of hair and fur; the places of production, markets, and prices; and, finally, gives some useful information concerning the parasites of hair and the means of contending against them. Paris: J. B. Baillière et Fils.

The Journal of Physiology, edited by *Michael Foster* and other eminent physiologists, among whom are four Americans, is the leading organ of original physiological investigation in the English language. The double number, 1 and 2 of Volume XIII, contains three articles with, in all, seven plates of curve tracings. The articles are on Some of the In-

fluences which affect the Power of Voluntary Muscular Contractions, by Warren P. Lombard; The Influence of Temperature and of Endocardiac Pressure on the Heart, and particularly on the Action of the Vagus and Cardiac Sympathetic Nerves, by G. N. Stewart; and The Blood-Corpuscles of the Crustacea, together with a Suggestion as to the Origin of the Crustacean Fibrin Ferment, by W. B. Hardy. Cambridge, England: Cambridge Engraving Company. Price, 12*s.*; $5 a volume.

Humanity and Health is a monthly journal, of which we have received the first number, published by *E. A. Jennings*, M. D., at 18 Clinton Place, New York. It is devoted "to the physical, mental, moral, and spiritual health of mankind"; the just and humane treatment of all men, women, and children; the inculcation of charity, of judgment, and the spirit of forgiveness, to equal rights, the cause of the oppressed, and other objects pertaining to the welfare of mankind; and we observe that it has kind words for animals. Pp. 14. Price, 10 cents; $1 a year.

Part I, Volume XXVI, of Annals of the Astronomical Observatory of Harvard College, relates to the *Preparation and Discussion of the Draper Catalogue*, and is by Prof. E. C. Pickering. The Draper Catalogue is named from Dr. Henry Draper, who took in 1872 the first photograph of a star in which the characteristic lines are visible. The work, interrupted by his death in 1882, is now continued at the Harvard Observatory under the Henry Draper Memorial Fund which was established by his widow. The history and progress of the Memorial are described in the introduction to the present volume. The portion of Part I which follows this account gives a description and discussion of the Draper Catalogue and of the other work done with the Bache telescope from 1885 to 1889. Accounts of other divisions of the work are promised in Part II, which is yet to be published.

The second part of the twentieth volume of the Annals of the Observatory of Harvard College gives an account, by *A. Lawrence Rotch*, of the *Observations made at the Blue Hill Meteorological Observatory* in 1889—a history and description of the Observatory, with an account of its instrumental equipment and the methods of observation and reduction, having been previously given in Part I of the volume. To the tables of the year's observations are added appendixes containing observations at Boston and at Blue Hill during the five years 1886–1890, with a summary of the diurnal and annual periods at Blue Hill as shown by the tables.

The first number of the *Engineering and Mining Journal* for 1892 (January 2d) is the annual statistical number, and contains the *Mineral Statistics for 1891*. These statistics have been collected with great pains and at heavy expense, and are claimed to be the only statistics of the whole mineral industry published until the Government reports, which are not likely to appear for a year. We are further told that the highest and best known authorities in every part of the world have contributed, each in his specialty, to this record. Besides the official returns of nearly all the important minerals and metals, it gives statements of the sources of production, the occurrence of the minerals, the use and values of their products, and in many cases the stocks of metal on hand at the close of the year.

The *Elementary Algebra* of Dr. *Charles Davies* has for many years held a high place among mathematical text-books. It is so arranged as to conduct the pupil by easy and simple gradations from the arithmetical processes to the more abstract methods of analysis, and to be introductory to the best works of higher algebra. The new edition which the American Book Company now publish has been edited and brought up to date by Prof. *J. H. Van Amringe*, of Columbia College. Among its peculiar features are the expansion and simplification of the subject of factoring, with the greatest common divisor and least common multiple; the extension of evolution to embrace any root; and greater simplicity and thoroughness in the treatment of series and logarithms.

The volume *Consumption; how to Prevent it and how to Live with it*, has grown out of the preparation by the author, *N. S. Davis, Jr., M. D.*, of a series of hygienic rules for his patients, with brief explanations of the effect of their execution. The author has faith in the power of hygiene, and expresses the belief that consumption could be reduced everywhere to very moderate limits if the bodies of children and growing youths were properly developed physically, and if the hygiene

of our homes, offices, and factories were more perfect than it is. In this book the accounts of the modes of action of climates, forms of exercise, kinds of labor, etc., are brought together and presented in intelligible shape. Published in Philadelphia by F. A. Davis.

The third of the Studies in History, Economics, and Public Law, published by Columbia College, is a *History of Municipal Land Ownership on Manhattan Island*, by *George Ashton Black* (Prof. E. R. A. Seligman, 50 cents). Mr. Black describes the transactions and policy of the city of New York concerning land from 1654, when, under the name of New Amsterdam, it acquired its first piece of real estate, down to the beginning of sales by the Commissioners of the Sinking Fund in 1844. Sixteen maps of parts of the city accompany the monograph.

The U. S. Artillery School at Fort Monroe, Va., has begun the publication of a quarterly magazine called the *Journal of the United States Artillery*. The first number contains articles on the motion and velocity of projectiles, our artillery organization, and the Chilian Navy. The subscription price is $2.50 a year.

The New World is a quarterly review of religion, ethics, and theology, the first number of which has been issued recently (Houghton, $3 a year). It is under the charge of an editorial board consisting of Profs. C. C. Everett and C. H. Toy, of Harvard University, President Orello Cone, of Buchtel College, and Rev. N. P. Gilman, author of The Laws of Daily Conduct, the last named being the managing editor. The prospectus states that "the new quarterly will be open to able and constructive thinkers, without regard to sectarian lines. The New World which its editors have in mind is that which is developing under the light of modern science, philosophy, criticism, and philanthropy —all of which, rightly viewed, are the friends and helpers of enduring religious faith. To positive and constructive statements of such an order of things, as distinguished from the old world of sectarianism, obscurantism, and dogmatism, the New World is pledged." Each number will contain 200 pages. In the first number the opening article is on The Evolution of Christianity, by Lyman Abbott; and other contributors are C. C. Everett, J. G. Schurman, W. R. Alger, C. H. Toy, J. E. Carpenter, T. R. Slicer, E. H. Hall, and C. B. Upton. There is a department of Book Reviews, and in future it is intended to have in each number a survey of current periodical literature on religious subjects. The New World frankly admits the influence which the doctrine of evolution and the scientific method of research are exerting in the field of religion, and promises well to become a force that shall carry this influence onward to a more perfect freedom and to an unrestricted acceptance of the truth.

The poems by *H. L. Gordon*, in the handsome volume entitled *The Feast of the Virgins and other Poems*, having been printed for the author's friends rather than for the public, are hardly subjects for criticism. They were for the most part composed during the author's life in the Northwest—on the frontiers of civilization—and bear the marks of the personal acquaintances which he says he has had with Indians of the Dakota and Ojibway nations. A considerable proportion of them relate to Indian subjects, and, in versifying Dakota legends, the attempt has been made to present faithfully many of the customs and superstitions and some of the traditions of that people. While very little poetic license has been taken with their traditions, none has been taken with their customs and superstitions. These poems may therefore be regarded as contributions to Indian lore. Published in Chicago by Laird & Lee.

Simeon Pease Cheney, author of the American Singing-Book, was a musician and music teacher, who lived thirty summers in a bird-haunted grove, and who took notice of bird songs in Vermont, New Hampshire; St. Lawrence County, New York; and southern Massachusetts. In his sixty-seventh year, with no authorities but his own observations—for he never read but four books about birds, and these not till more than half the work he accomplished was done—he undertook the collection of New England bird-songs. His intention was to write a book for the young people of New England, to be made up of bird-songs and observations on the domestic animals, with special reference to their several forms of utterance, and of notices of the music of inanimate things. He died with his work unfinished in May, 1890. His notes

have been collected and edited by Mr. John Vance Cheney, and are published, with much supplementary matter in the appendix, as *Wood Notes Wild*, by Lee & Shepard, Boston. The author warmly controverts the assertion of a modern English writer that there is no music in Nature, and in contradiction of it presents a transcript of the song of water dropping into a bucket, and the melody of a whirling clothes-rack. Following these, he gives his observations and transcriptions of the notes—some of them forming various melodies—of forty-one birds, beginning with the bluebird and robin, and closing with owls and the hen—all of which, he avers, contain the essential elements of true music. In the appendix, the editor presents all that he has been able to find, by citation or reference, that has been said by other authors on the music of birds, and has combined much valuable information on the subject.

The Financial History of Massachusetts, from the Organization of the Massachusetts Bay Company to the American Revolution, is a volume of the Columbia College Series of Studies in History, Economics, and Law, by *Charles A. Douglas*. It is presented as a necessary antecedent to an intelligent investigation of the financial phenomena of the later period of the history of the State, which are regarded as far more complex, as well as fuller of interest, than those embraced within the scope of the present essay. In his treatment the author has given space to the exposition of administrative features, rather than to numerical statements—very properly, we think, in view of the close relation of such features to fundamental principles, and of the fragmentary and unsystematic character of the financial records. We are sorry to observe the author apologizing for involved style in some parts of his work. With a language so capable of giving clear and simple expression to every thought as the English, we can recognize no sufficient excuse in a careful work for the want of it.

Opposite views of the money question are taken in two pamphlets that are before us—Two *Essays in Economics*, by *John Borden* (S. A. Maxwell & Co., Chicago), and a lecture by *Alfred B. Westrup* on *Citizens' Money* (The Mutual Bank Propaganda, Chicago). Mr. Borden's essays are on Wealth and American Money, and are well-reasoned and well-tempered presentations of the sound financial view that the circulation must have a basis of real value. Wealth is defined, its different kinds are distinguished, false definitions of it are exposed, and it is considered with reference to its sum and its owners. In American Money are discussed the standard, tokens, the medium of exchange, the volume of the currency, money as a store of wealth, and paper money. In his lecture on Citizens' Money, Mr. Westrup insists that sufficient volume and facilities must be provided to enable all wealth to be represented by money; that this representative should be loaned at cost; that absolute security must be given to the holder of paper money; and that the present system of control and restriction of the currency by Government is wrong.

PUBLICATIONS RECEIVED.

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American Society of Naturalists. Report on Science Teaching in the Schools. Boston: Rockwell & Churchill. Pp. 14.

Arizona, University of, Tucson. Bulletin of School of Mines, No. 2. Pp. 10.

Astronomical Society of the Pacific. Publications. Vol. III, No. 15. Pp. 72.

Baker, Charles. Patti Waltz. Tyrolienne. New York: Baker & Helmick. Pp. 3. 40 cents.

Beardmore, W. Lee. The Drainage of Habitable Buildings. New York: Macmillan & Co. Pp. 89. $1.50.

Benedict, W. R., Cincinnati. Psychological Table. Chart.

Bernard, Henry Mayness. The Apodidæ: A Morphological Study. New York: Macmillan & Co. Pp. 316. $2.

Booth, Charles. Pauperism and the Endowment of Old Age. New York: Macmillan & Co. Pp. 355. $1.25.

Boston Public Schools. Report for 1891. Pp. 74.

Brinton, D. G. Anthropology as a Science and as a Branch of University Education.—Studies in South American Native Languages. Philadelphia: McCalla & Co. Pp. 88.

Carlyle, Thomas, The Last Words of. New York: D. Appleton & Co. Pp. 383. $1.75.

Cathcart, George R. Cathcart's Literary Reader. New York: American Book Co. Pp. 541. $1.15.

Chicago Manual Training School. Catalogue, 1891–'92. Pp. 32.

Churchill, Lord Randolph S. Men, Mines, and Animals in South Africa. New York: D. Appleton & Co. Pp. 337, with Map. $5.

Conn, Dr. H. W., Middletown, Conn. Some Uses of Bacteria. Pp. 28.

Cowperthwait, J. Howard. Money, Silver, and Finance. New York: G. P. Putnam's Sons. Pp. 242. $1.25.

Cushing, Frank H. A Zuñi Folk-tale of the Underworld. Pp. 18.

Dawson, G. M. Notes on the Shuswap People of British Columbia. Pp. 44, with Plate.

Devil's, The, Visit. New York: Excelsior Publishing House. Pp. 448.

Dominion, The. Illustrated Monthly. May, 1892. Montreal. Pp. 64. 15 cents. $1.50 a year.

Durfee, W. F. In Memoriam. Charles Alfred Hobbs. Pp. 12.

Falkener, Edward. Games, Ancient and Oriental, and how to play them. New York: Longmans, Green & Co. Pp. 366. $6.

Gill, Theodore. Notes on the Tetraodontoidea. Pp. 16, with Plate.—On the Genus Chonerhimes or Xenopterus. Pp. 3.—On the Genus Gnathanacanthus of Bleeker. Pp. 4.

Ginn & Co., Boston. Catalogue and Announcements for 1892. Pp. 163.

Gordon, E. M. A Warning to all the Inhabitants of this World. Philadelphia. Pp. 35.

Greswell, Rev. W. P. Geography of Africa South of the Zambesi. New York: Macmillan & Co. Pp. 400, with Three Maps. $2.

Gunton, Prof. George. Taxation and Revenue. The Protectionist View. New York: D. Appleton & Co. Pp. 20. 10 cents.

Halsted, Byron D., New Brunswick, N. J. Some Fungi Common to Wild and Cultivated Plants. Pp. 6.—A Century of American Weeds. Pp. 8.—Report of the Botanical Department, New Jersey Agricultural Experiment Station. Pp. 108.—Syllabus of Lectures on Botany. Pp. 16.

Henry, M. Charles. Les Odeurs (Odors). Paris, France: A. Hermann. Pp. 68.

Holbrook, M. L., M. D. The Hygienic Treatment of Consumption. New York: M. L. Holbrook & Co. Pp. 219. $2.

Humanity's Spreading Curse. The Scribes and Pharisees. By One of them. Dallas, Texas: E. H. Andrae. Pp. 106. 35 cents.

Hurst, George H. Silk Dyeing, Printing, and Finishing. New York: Macmillan & Co. Pp. 226, with 166 samples. $2.

Illinois State Board of Health. Eleventh Annual Report. Springfield. Pp. 236.

Ingersoll, Robert G. Thomas Paine. Buffalo, N. Y.: H. L. Green. Pp. 10. 10 cents.

James, U. P., Cincinnati, Ohio. Catalogue of Scientific Books. Pp. 24.

Landauer, J., and Taylor, James. Blowpipe Analysis. New York: Macmillan & Co. Pp. 173. $1.10.

Leverett, Frank. On the Correlation of Moraines with Lake Beaches of Lake Erie. Pp. 20.—Pleistocene Fluvial Planes of Western Pennsylvania. Pp. 14.

McGuire, J. D. Materials, Apparatus, and Processes of the Aboriginal Lapidary. Pp. 12.

Mackenzie, Alexander. Implements, Weapons, etc., from Graham Island, Queen Charlotte Islands. Pp. 16, with Plates.

Marshall, Alfred. Elements of Economics of Industry. New York: Macmillan & Co. Pp. 416. $1.

Michigan, University of. University Record, April, 1892. Quarterly. Pp. 24. 12 cents, 50 cents a year.

Morris, R. Anna. Physical Education in the Public Schools. New York: American Book Co. Pp. 192. $1.

Monroe, W. S. A Pedagogical Library. Pp. 12. Oakland, Cal.: Philip M. Fisher. Pp. 12.

Naegeli, Prof. Carl, and Schwendener, Prof. S. The Microscope in Theory and Practice. New York: Macmillan & Co. Pp. 382. $2.60.

Parmalee, Mary. Who? When? and What? Famous Men and Events of Six Centuries. Wall-chart. 50 cents.—Answered in the Negative. Pp. 203. 50 cents. New York: Parmalee & Chaffee.

Patterson, H. J. Report of Chemist, Maryland Agricultural Experiment Station. Pp. 48.

Pennell, Joseph. The Jew at Home. New York: D. Appleton & Co. Pp. 105. $1.

Physical Education. Vol. I, Nos. 1 and 2. Springfield, Mass. The Triangle Publishing Co. Pp. 18 each. Monthly. $1 a year.

Pierce, Newton B. A Disease of Almond Trees. Pp. 12, with Plates.

Pillings, J. C. Bibliography of the Algonquian Languages. Washington: Bureau of Ethnology. Pp. 614.

Poor, Laura E. Life and Writings of John Alfred Poor. New York: G. P. Putnam's Sons. Pp. 400. $3.

Potts, William. The Monetary Problem. New York: D. Appleton & Co. Pp. 36. 10 cents.

Ramsey, Samuel. The English Language and English Grammars. New York: G. P. Putnam's Sons. Pp. 570. $3.

Redding, Jacob, M. D. Physiology, its Science and Philosophy. New Castle, Ind. Pp. 632.

Reid, H. F. Studies of the Muir Glacier, Alaska. Washington: National Geographic Society. Pp. 84. $1.

Rose Polytechnic Institute, Terre Haute, Ind. Catalogue, etc., 1892. Pp. 50.

Salter, W. M. Freedom of Thought and of Speech. Chicago: C. H. Kerr & Co. Pp. 29.

Sampson, Z. Sidney. The Immigration Problem. New York: D. Appleton & Co. Pp. 24. 10 cents.

The Sanitary Inspector. Monthly. Pp. 12. Augusta, Me. 25 cents a year.

Schwahn, J. G. The Tableau; or, Heaven as a Republic. Los Angeles, Cal.: Franklin Printing Co. Pp. 233. 50 cents.

Shearman, Thomas G. Taxation and Revenue. The Free-Trade View. New York: D. Appleton & Co. Pp. 32. 10 cents.

Smithsonian Institution. Report for 1890. Pp. 808.—Report United States National Museum. 1888-'89. Pp. 980.

Spencer, Herbert. Social Statics; or, Man vs. the State. New York: D. Appleton & Co. Pp. 420. $2.

Thomas, A. R., M. D. Evolution of the Earth and Man. Philadelphia. Pp. 30.

Trelease, William. Revision of Rumex. St. Louis. Pp. 98, with 33 Plates.

The Treasury of Religious Thought. J. Sanderson, LL. D., Editor. New York: E. B. Treat & Co. Monthly. Pp. 92. 25 cents, $2.50 a year.

United States Artillery Journal. Quarterly. Fortress Monroe, Va.: Artillery School Press. Pp. 86. 25 cents, $2 a year.

United States Geological Survey. Mineral Products. Chart.

United States Signal Service. Normal Temperature Charts by Decades. 71 Charts.

Wadsworth, M. E. The South Trap Range of the Keweenaw Series. Pp. 3.

The Wool Book for 1892. Compiled by S. D. North. Boston: National Association of Wool Manufacturers; S. D. North, Secretary. Pp. 122.

POPULAR MISCELLANY.

The American Tea Plant.—The *Ilex cassine*, or *youpon*, is a shrub or small tree which grows in the Southern States, along the sea-coast, to not more than twenty or thirty miles inland, from Virginia to the Rio Grande. Its leaves and tender branches were once used by the Indians in the same way that the Chinese tea and the Paraguay

tea are used. But the drinking of this tea has been nearly if not quite abandoned. A study of its history has been made by Dr. E. M. Hale, who has examined all the references to it he could find, and has started an inquiry into the reason why it has been abandoned, and the expediency of reviving its use. Its leaf, according to the analysis by Prof. Venable, of the University of North Carolina, contains caffeine. It is not so pleasant in odor and taste as the Chinese tea; but it seems to have some salutary properties which the latter does not possess, and may perhaps be more cheaply obtained. Dr. Hale estimates the extent of the land over which it grows as about forty thousand square miles, and suggests that careful experiments in cultivation and manipulation might result in furnishing our markets with a product that would be found in many cases an acceptable and useful substitute for the more expensive imported teas.

Many-toed Horses.—The derivation of the recent horse's foot with one digit from ancestors with polydactyl feet has been carefully traced by Prof. O. C. Marsh in his published papers on that subject. Several instances have come to the author's knowledge of existing horses presenting more than one toe. Julius Cæsar's horse had this peculiarity. Its feet are described by Suetonius as having been almost human, with the hoofs cleft like toes. "It was born in Cæsar's own stables, and, as the soothsayers declared that it showed that its owner would be lord of the world, he reared it with great care, and was the first to mount it. It would allow no other rider." The main functional toe of each foot of the horse is the third digit, corresponding to the middle finger of the human hand. In addition to these, two "splint-bones," one on each side of the main cannon-bone, are present beneath the skin—the remnants of two other toes possessed by ancestors of the horse. One or more of these splint-bones may become enlarged below and support phalanges, forming another digit beside the main one, or, more commonly, developing into a small external toe, with hoof. The occurrence of such extra digits in the recent horse is much more frequent than is generally supposed. Prof. Marsh has examined several living animals presenting this peculiarity, and has received photographs, drawings, and detailed descriptions of others. The extra digit may appear on one foot, when it is smaller than the main digit, and is usually on the inner side on the fore foot. It may often be entirely under the skin, with the only external evidence of it a prominence, in which its form may be made out. A corresponding extra toe may be present on the other fore foot; a second extra digit may exist with the others, but outside the main digit; with the extra inner toes of the fore feet, another of equal or smaller size may be present on one or both of the hind feet, almost always on the inside; in rare cases, both fore and hind feet may each have two extra digits fairly developed, and all of nearly equal size; or sometimes, besides the extra toes already described, which appear to be the second and fourth, the first digit, or pollex, may be represented by its metacarpal, supported by a distinct trapezium, all beneath the skin. A large majority of the polydactyl horses known to Prof. Marsh in this country have been raised in the Southwest, or from ancestry bred there, so that their connection with the mustangs or semi-wild stock of that region becomes more than probable. The fact that the tendency to reversion is much stronger where animals run wild must be taken into consideration in discussing the question of the origin of these animals.

Temperature of Lake Waters.—The investigations of Mr. A. T. Drummond on the temperatures of some Northern lakes and rivers have shown him that the Georgian Bay is, in its main expanse, a large body of cold water whose temperature, at its greater depths, is not much influenced by the heat of summer, while the central and southern basins of Lake Huron, although also receiving surplus waters from Lake Superior, stand in the line of inflow of the warmer waters from Lake Michigan and of their ultimate exit by way of the river St. Clair to the lower lakes, and are consequently somewhat warmer basins. Among the details of observations recorded in his papers, we find that tests at the rapids of the Richelieu River at Chambly seem to show that the motion of the water during the mile of continuous rapid raises the temperature of the water perceptibly. Rapid currents have, however, the effect of equal-

izing the temperature of the water. Under conditions appearing to be the same, and at points relatively near to each other, the water on the surface of the lakes and rivers is not uniform in temperature, but seems to flow in areas of different temperatures. It is impossible to lay down any general rule regarding the changes of temperature varying with the increase in depth. Apart from variations resulting at the different seasons, surface readings are affected by sunlight and cloud, gusts of wind, channel currents, the inflow of affluent streams, and the physical features of the surrounding land. Readings beneath the surface are affected by the depth of the water, by ordinary currents resulting from changes of level, by evaporation at the surface creating an upward flow of the water underneath, by the contour of the bottom, and by high winds which drive the surface waters before them, creating return currents underneath to take their place. The general rise of the temperature of Lake Ontario waters as the summer advances is at first slow, compared with the general rise of the temperature of the air, but, as midsummer is reached, the rise is more rapid both at the surface and at the bottom. The absorption and retention power of the sun's heat is most noticeable in the small streams and quiet pools. In the case of rivers, the air in direct contact with the warm surface of the water has its temperature in early August raised to from 1° to 5° above that of the air directly above, but in more exposed positions; and this increase in temperature, which is greatest at the point of contact, is, at one foot above the surface of the water, already to a considerable extent lost.

The Value of Human Testimony.—The argument of a book by Mr. Thomas Fitzarthur on the Value of Human Testimony is, according to the summary of The Spectator, that the value depends in a great measure on the importance attached by the witness to the facts to which he testifies. If the fact is insignificant, if his interest in it is languid, and it has no real bearing on his life, it is not to be supposed that he will take the trouble to attend to the matter with the care and the anxiety to be sure of what he sees or hears which is necessary to make his testimony of real weight for other people. But if it is a fact on which a great change in his own career depends, if it alters his whole life, his whole character, if it involves him in much labor and suffering, if it kindles in him an altogether new ideal of purpose, then we may be sure that his testimony is both honest and careful, and that, if it is supported by a great deal of other testimony of the same nature, it is in the highest degree trustworthy. Further, the author insists that its transmission through a long line of tradition does not invalidate its authority. We should not attach much value to details so transmitted. If we were dependent on testimony transmitted from generation to generation as to the numbers and character of the forces engaged in the battle of Hastings, we should not attach much weight to it. But such a long line of transmission would not diminish the value of the testimony as to the reality of that battle, and its result in the defeat of the Saxon and the victory of the Norman army. We should be well aware that that testimony must have been transmitted through a great many unwilling as well as a great many willing and triumphant witnesses. We should be well aware that all those witnesses must have had before their eyes the amplest evidence of the actual event, and of the revolution it brought about in the history of England. And we should never think of supposing anything so absurd as that at some specific date there was a deliberate conspiracy formed by hundreds of thousands of living Englishmen to alter the whole drift of the testimony they had received from their fathers, and invent a battle which never took place, or reverse its issue, and that that conspiracy should have succeeded in persuading the unborn generations to believe a gigantic lie. There could be neither machinery nor motive for such a successful conspiracy, and consequently the common sense of mankind at once rejects a hypothesis so audacious and absurd, with contempt.

Miss North's Animal Friends.—Miss Marianne North relates, in her Recollections, that while sketching an old Hindu temple at Blaune Watu, Java, she felt hungry and began eating a biscuit as she went on with her work. Shortly she was disturbed by a pull at her dress, and found a large monkey sitting beside her and looking reproachfully at

her, "with the expression of 'How can you be so greedy? why don't you give me a bit?' Of course he did get it, and then departed and hid himself in the leaves overhead." At a place in California, where she stayed after all the other visitors had deserted it, "a stag," she says, "with great branching horns was my only companion; he had a bell round his neck, and used generally to live in front of the house, but liked human company; and when I appeared with my painting things he would get up and conduct me gravely to my point, and see me well settled at my work, then scamper off, coming back every now and then to sniff at my colors."

The Succession of American Floras.—No strongly defined line can be drawn, says Prof. Warren Upham, in a paper on the flora of the basin of the Red River of the North, "between different portions of the flora and fauna of the country from the Atlantic to the Rocky Mountains and from the Gulf of Mexico to the Arctic Sea. But great contrasts exist between the Eastern region, with its plentiful rainfall, and the dry Western plains, as also between the almost tropical Southern margin of the United States and the tundras beneath the Arctic Circle. In traveling from the once wholly forest-covered country of the Eastern States, across the prairies, to the far Western plains bearing cacti and sage-brush, there is observed a gradual change in the flora, until a very large proportion of the Eastern species is left behind, and their places are taken by others capable of enduring more arid conditions. Likewise, in going from St. Augustine or New Orleans to Chicago, St. Paul, Winnipeg, and Hudson Bay and Strait, the palmettoes, the evergreen live-oak, bald cypress, Southern pines, and the festooned *Tillandsia*, or Spanish moss, are left in passing from the Southern to the Northern States; and instead we find in the region of the Laurentian lakes the bur or mossy-cup oak, the canoe and yellow birches, the tamarack, or American larch, the black spruce, balsam fir, and the white, red, and Banksian pines; while farther north the white spruce, beginning as a small tree in northern New England and on Lake Superior, attains a majestic growth on the lower Mackenzie in a more northern latitude than a large part of the moss-covered barren grounds which reach thence eastward to the northern part of Hudson Bay and Labrador. Thus, although no grand topographic barrier, like a high mountain range, impassable to species of the lowlands, divides this great region, yet the transition from a humid to an arid climate in passing westward, and the exchange of tropical warmth for polar cold in the journey from South to North, are accompanied by gradual changes of the flora, by which in the aggregate its aspect is almost completely transformed."

Timber-testing.—The Forestry Division of the Department of Agriculture is engaged in making tests of timber, for the purposes of obtaining a better knowledge of the qualities of our commonest commercial timbers; of devising means of relating qualities to physical structure and appearance; and to establish, if possible, the influence which divers conditions of growth exercise upon the quality—all conditions affecting the usefulness of the specimens in service. The records, which are preserved in duplicate, include the definition of the locality where the piece was cut, with its geological and climatological features; an exact description of the site and exposure, the soil, and the surrounding growth and undergrowth; the origin of the tree, its age and dimensions; the positions in the tree of the various test-pieces submitted; and other points. It is expected to submit to the regular series of tests between one and two thousand test-pieces of each species. It is hoped that when the work is done means will be afforded the engineer and architect to specify for timber of given quality, and also, by a rapid macroscopic and microscopic examination, to pass on each stick as to its coming up to the specification; and, further, of acquainting ourselves with the conditions of growth that produce given quality.

The Preservation of Historical and Interesting Scenery.—At the instance of the Appalachian Mountain Club, a law has been enacted in Massachusetts incorporating a Board of Trustees of Public Reservations, with authority to acquire, hold, arrange, maintain, and open to the public, under suitable regulations, beautiful and historical

places and tracts of land within the Commonwealth. The property thus acquired, which can not, with its appurtenances, exceed two million dollars in aggregate value, is exempt from taxation, unless it is held longer than two years without being opened to the public. While the corporation enjoys these privileges, it is forbidden to own any capital stock or to make any division of property or income among its members, or any dividends. Mr. George F. Hoar has been chosen President of the Board. The trustees received last year several recommendations or offers of property as coming within the category of the purposes for which they are acting, and have considered the expediency of purchasing them; and Mr. J. B. Harrison, their agent, has made an inspection of the sea-coast towns of the State, with a view to the provision of public access to the beach and the establishment of seashore parks. The establishment of the board will enable the admirers of the scenery or history of any spot in the State to make that spot a reservation and to provide for its perpetual care, and will enable the proprietors of pleasure resorts and the people of communities which make money from the attractiveness of fine scenery to insure the perpetuation of such attractions and of their profits. Similar provisions should be made in all the States.

Characteristics of Star Spectra.—The general conclusion derived from the study of the spectra of the stars, says Prof. E. Pickering, in his account of the Henry Draper Memorial, is the marked similarity in constitution of different stars. A large part of them—the stars of the "first type"—have a spectrum which at first sight seems to be continuous, except that it is traversed by broad dark bands, due to hydrogen. Closer inspection shows that the K-line is also present as a fine dark line. If the dispersion is large and the definition good, many more dark lines are visible. These lines may be divided into two classes: First, those which predominate in many stars in the milky way, especially in the constellation of Orion; and, second, those present in the solar spectrum. Nearly all the brighter stars may be arranged in a sequence, beginning with those in Orion, in which the auxiliary lines are nearly as intense as those due to hydrogen. Other stars may be found in which these lines successively become fainter and fainter, till they have nearly disappeared. The more marked solar lines then appear, become stronger and stronger, and the hydrogen lines fainter, till they gradually merge into a spectrum apparently identical with that of the sun. Continuing the sequence, the spectra pass gradually into those of the third type. Certain bands become more marked, and the spectra of the third type may be divided into four classes, in the fourth of which the hydrogen lines are bright instead of dark. This spectrum appears to be characteristic of the variable stars of long period when near their maximum. It has led to the detection of several new variable stars, and has been confirmed in many of the known variables. Slight peculiarities are noticed in the spectra of many stars, but these deviations are not sufficient to affect the general law. Stars of the fourth type, whose spectra appear to be identical with the spectrum of carbon, are not included in this classification. Other stars, whose spectra consist mainly of bright lines, like those of the planetary nebulæ, may be included with them in a fifth class.

The Reason of the Slave Trade.—A Moslem view of the slave trade is presented in the Saturday Review—not to excuse the traffic, but to show why it is carried on. The slaves are mostly children, "black, uncomely, and unpromising." They are not sought for the harem, in the conventional sense of that word. "The truth is, that certain conditions of domestic life among civilized Moslems exact a supply of slaves without regard to beauty or even to physical strength. The interruption of that supply has caused as much dismay and confusion as a law to forbid the employment of unmarried girls for household service might effect in England. It would be found at once that there were not matrons or widows enough to do the work, that few of them would undertake it, and fewer still were competent. Such a law would be evaded at every peril. No class of women in a Moslem community has the tradition of domestic service, as it may be called. Very commonly a free girl was taken into the household of some matron as a child, and there brought up; but she

never dreamed of changing. One of the conditions was, and is, that her patroness shall provide a husband for her. Often enough, also, the child of such a *protégée* succeeds to her place when old enough, and thus very pleasing relations are established between families of different status. . . . The practice of adopting girl-children to train as servants becomes more and more common as slaves become scarcer. . . . A class of domestic servants is being formed which, in due time, will replace the slaves. But transformations of the sort are very, very slow in the East. Meanwhile the process is very disagreeable, even shocking, to Moslem housewives, and it is not at all surprising that they should pay heavily and run some risk to obtain a negro who is all their own."

Lake Beaches.—In his discussion of the beaches and their correlative moraines of Lake Erie, in the American Journal of Science, Mr. Frank Leverett shows that the belief of geologists now is that the phenomena do not demand a submergence of the land during the closing stages of the Glacial epoch; that, instead of a depression, there was a greater altitude than in the earlier part of the period; and that the result of investigation has been to reduce the noteworthy lakes connected with the closing stages of glaciation in Ohio to the one bounded by the beach lines that were recognized by the Ohio Geological Survey. The examination of the phenomena in detail leads to the conclusion that Lake Erie, in its earlier stages, was but a small body of water, its size being conditioned by the position of the retreating ice-sheet and by the height of the western rim of the basin it occupied.

NOTES.

The arrangements for the meeting of the American Association, to be held in Rochester, N. Y., in August, are nearly completed. The meeting will be opened on Tuesday evening, the 17th, with an address by Secretary F. W. Putnam. President Joseph Le Conte will deliver an address on Wednesday evening, the 18th; a reception will be given the Association by the ladies of the city at the Powers Art Gallery on Thursday, the 19th; and a public lecture will be given on Friday evening. The business meetings will be held in the university. The Saturday excursions will include visits to Niagara Falls, Portage, Mount Morris, Canandaigua Lake, and Watkins Glen, and the long excursion will be to the Adirondack region.

The second annual session of the School of Applied Ethics will be held at Plymouth, Mass., July 6th to August 17th. The programme of instruction includes six courses of five lectures each in the History of Religions; seven courses in Economics; and a series of fifteen lectures by Prof. William Wallace, of Oxford, on Variations of the Moral Standard, illustrated by the History of Ethical Theories; with four other courses in Ethics. Applications may be made to the secretary, S. Burns Weston, 118 South 12th Street, Philadelphia.

In Uruguay, according to Admiral Kennedy, of H. M. S. Ruby, barbed wire has played a part in suppressing revolutions, as it is not easy to march troops over a country intersected by it.

A *Postschule* is to be established at Leipsic for the special training of post-office assistants, and eventually also of postmasters. The course of instruction will embrace, besides the usual branches, the subjects belonging to the postal service.

According to Dr. R. W. Shufeldt's observations of the Navajo belt-weavers, curves are never found in the figure-patterns on the belts or blankets, but horizontal stripes, diagonals, and the lozenge are interwoven with a variety that appears to be almost endless in the matter of design. The leading colors used are red, brilliant orange-yellow, a blue, and by combination a green, and black, white and gray.

The results of the observations of Mr. H. C. Russell, of Sydney, on the Grouping of Stars in the Southern Part of the Milky Way were described by him at the Australasian Association as tending to diminish the value of the rifts in the discussion of stellar distribution.

The detailed meteorological observations, made under the direction of H. B. de Saussure simultaneously on the *Col du Geant*, at Geneva, and at Chamounix, in July, 1788, have been published in the memoirs of the Physical Society of Geneva. Only the means of a part of the observations were published by De Saussure in his Voyages dans les Alpes.

The nest and egg of a bird-of-paradise have been found by two Australian gentlemen on an island off the coast of Queensland, and have been described by Mr. A. J. Campbell in the Victoria Field Naturalists' Club. The hen was watched till she flew into the crown of a pandanus tree, where her head could be seen as she sat on her nest.

The nest was about ten feet from the ground, and was somewhat loosely constructed of broad, dead leaves and green branchlets of climbing plants and fibrous material. Inside were two large concave dead leaves underneath pieces of dry tendrils, which formed a springy lining for the egg or young to rest upon. The nest contained a single egg; was nineteen centimetres broad and nine deep; and the egg cavity was nine centimetres by four.

A PROPOSITION to establish a marine biological station in Jamaica as a memorial of Columbus is approved by Prof. Huxley and Prof. Ray Lankester, who regard the situation as a most excellent one for the study of intertropical life.

A SMALL axe of nephrite found at Ohlau, in Silesia, has been identified as to the specific gravity, microscopic structure, and chemical composition of the stone, as the same with a mineral occurring near Jordansmühl, in Silesia. This is the only prehistoric object found in Europe of which the source has been satisfactorily determined.

AMONG the items of progress in chemistry in Australia, Mr. W. M. Hamlet mentions the discovery of the alkaloids brucine and strychnine in the fruits of *Strychnos pilosperma*, by Prof. Rennie and Mr. Goyder; and the work done by Mr. J. H. Maiden in the examination of Australian kinos, gums, and barks. Chief among this chemist's researches was his work on wattle bark, which he found contains from fifteen to forty-six per cent of tannic acid. As the wattle tree is easy of cultivation, it thus promises to be valuable. Mr. Kirkland has discovered gallium and indium in some specimens of blende. Some work has been done toward determining the actual state of combination in which elements occur in different ores.

THE first part of an account of the origin and development of the Royal Gardens at Kew has been published by Mr. Thiselton Dyer, in the Kew Bulletin. The present installment of the story relates the earlier period of the history, when the gardens were a purely private possession of the crown, and closes with the time when, in 1841, they became a national institution, with Sir William Hooker as director. For this early period there are hardly any authentic records, and the author has had "to fall back on local traditions, on local histories, the statements of which are often confusing and inaccurate, and on such scattered notices as could be gathered from contemporary literature." The history of the last half-century of the gardens will be given in another number of the Bulletin.

IN a lawsuit recently decided in London, a householder had two poplar trees near a railway, which the railway company wished removed. He was willing to shorten the branches, but not to cut the trees down. The company sent in its men, who felled the trees, and then offered to settle with the owner, first by giving him two hundred and fifty, and later by offering him five hundred dollars. He carried the case to the court, which gave him fifteen hundred dollars for the trees and additional damages of a thousand dollars for the injury caused by their removal.

VIOLETS of highly intensified colors have appeared on the streets of Paris, where curiously colored lilacs and narcissuses are likewise offered for sale. According to M. Gaston Tissandier, in *La Nature*, the flowers sold in Paris are artificially colored by placing the stems in water containing an aniline dye of the tint desired.

MR. SMEE, of the Gresham Insurance Company, is credited with having declared that the company has paid out during the past two years, on account of deaths caused directly by influenza, two and a half times as much as it paid in forty-three years for deaths by cholera.

AN exhibition of weeds at the World's Columbian Exhibition is projected by Prof. Byron D. Halsted, who suggests that each person assisting secure at least three specimens each of the worst weeds in his State or section. Regard should be had, in collecting them to the seeds, which are especially desired; seedlings in various states of development; the root system; the flower and flower cluster; and the seed-vessel. To avoid unnecessary duplication, persons designing to collect for this enterprise are invited to communicate with Prof. Halsted at the State Experiment Station, New Brunswick, N. J., when their work will be arranged for them.

A CURIOUS custom is described by Dr. J. C. Evans as having prevailed at Oakham, Rutlandshire, England, by which a horseshoe, or payment in lieu thereof, was exacted from every peer passing through the town. The author exhibited to the Society of Antiquaries an iron horseshoe of super-equine dimensions, which had been deposited in the hall at Oakham in 1693, by Richard Cumberland, Bishop of Peterborough.

OBITUARY NOTE.

HERMANN FRANZ MORITZ KOPP, a famous German chemist, died at Heidelberg, February 20th, in the seventy-fifth year of his age. He joined Liebig in 1813 at Giessen, where he labored for nearly twenty-five years; became a privat-docent in the university in 1841, an extraordinary professor in 1843, and an ordinary professor in 1853; and was called to Heidelberg in 1864, where he remained till his death. His specialty was physical chemistry.